1990

SERVICE MANUAL

PREMIER
MONACO



CHRYSLER MOTORS

SAFETY NOTICE

CAUTION

ALL SERVICE AND REBUILDING INSTRUCTIONS CONTAINED HEREIN ARE APPLICABLE TO, AND FOR THE CONVENIENCE OF, THE AUTOMOTIVE TRADE ONLY. All test and repair procedures on components or assemblies in non-automotive applications should be repaired in accordance with instructions supplied by the manufacturer of the total product.

Proper service and repair is important to the safe, reliable, operation of all motor vehicles. The service procedures recommended and described in this publication were developed for professional service personnel and are effective methods for performing vehicle repair. Following these procedures will help assure efficient economical vehicle performance and service reliability. Some of these service procedures require the use of special tools designed for specific procedures. These special tools should be used when recommended throughout this publication.

Special attention should be exercised when working with spring or tension loaded fasteners and devices such as E-Clips, Circlips, Snap rings, etc., as careless removal may cause personal injury. Always wear safety goggles whenever working on vehicles or vehicle components.

It is important to note that this publication contains various **Cautions** and **Warnings.** These should be carefully read in order to minimize the risk of personal injury, or the possibility that improper service methods may damage the vehicle or render it unsafe. It is important to note that these **Cautions** and **Warnings** cover only the situations and procedures Chrysler Motors has encountered and recommended. Chrysler Motors could not possibly know, evaluate, and advise the service trade of all conceivable ways that service may be performed, or of the possible hazards of each. Consequently, Chrysler Motors has not undertaken any such broad service review. Accordingly, anyone who uses a service procedure, or tool, that is not recommended in this publication, must assure oneself thoroughly that neither personal safety, nor vehicle safety, be jeopardized by the service methods they select.

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To order the special service tools used and illustrated, please refer to the instructions on inside back cover.

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Foreword

The information contained in this service manual has been prepared for the professional automotive technician involved in daily repair operations. Information in this manual is divided into groups. Each group covers a general vehicle system (brakes, steering, body, etc.). Each group is further divided to address individual components or systems within the group.

The Component and System Index will assist you in locating the correct group for the component or system you require.

These groups contain general information, diagnosis, testing, adjustment, removal and installation, assembly and disassembly procedures for the components.

The diagnosis charts are designed to help you locate and correct problems with a systematic approach. The tab locator at the right side of this page will help you to quickly locate the first page of each group. The first page of each group contains an alphabetical index to assist in the location of the component or system.

The information, descriptions, testing procedures and specifications were in effect at the time this manual was released for printing.

Chrysler Motors reserves the right to change testing procedures, specifications, diagnosis, or repair methods at any time without prior notice or incurring obligation.

The information describing the operation and use of standard and optional equipment is included in the Operating Instructions and Product Information manual located in the glove box.

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—	Introduction
0	Lubrication and Maintenance Hoisting and Towing
2	Suspension Front, Rear Driveshafts
5	Brakes
7	Cooling System, Drive Belt Adjustments
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14	Fuel System
19	Steering
21	Transaxle
22	Wheels and Tires
23	Body
24	Heating and Air Conditioning
25	Emission Control Systems

VEHICLE CERTIFICATION LABEL

The certification label is affixed to the drivers side door pillar.

This label includes the vehicle build MDH (Month-Day-Hour) - (Fig. 1), the Gross Vehicle Weight Rating (GVWR), the Gross Axle Weight Rating (GAWR) and the Vehicle Identification Number (VIN).

CATALYST LABEL

The catalyst label is located at the rear of the drivers door below the door latch (Fig. 3).

The vehicle emission control informatin label (Catalyst Label) states that this vehicle conforms to E.P.A. regulations for the 1990 model year.

VEHICLE EMISSION CONTROL (MAINTENANCE) LABEL

The Vehicle Emission Control (Maintenance) Label (Fig. 2) gives pertinent tune-up specifications, vacuum schematics (for California only), engine type and emission type.

TIRE INFLATION LABEL

Check the tires for visible signs of wear which may indicate underinflation or a need for front-end alignment, tire rotation or wheel balancing. Also check for bulging, cracks or other road hazard damage. Check and adjust the inflation pressures according to the specifications listed on the tire pressure sticker attached to the back of the front left door (Fig. 3).

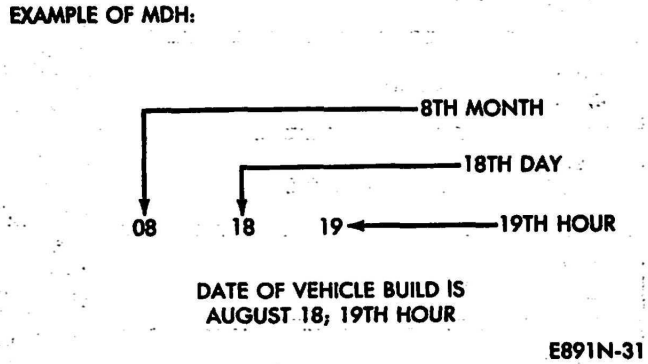


Fig. 1—Vehicle Build MDH

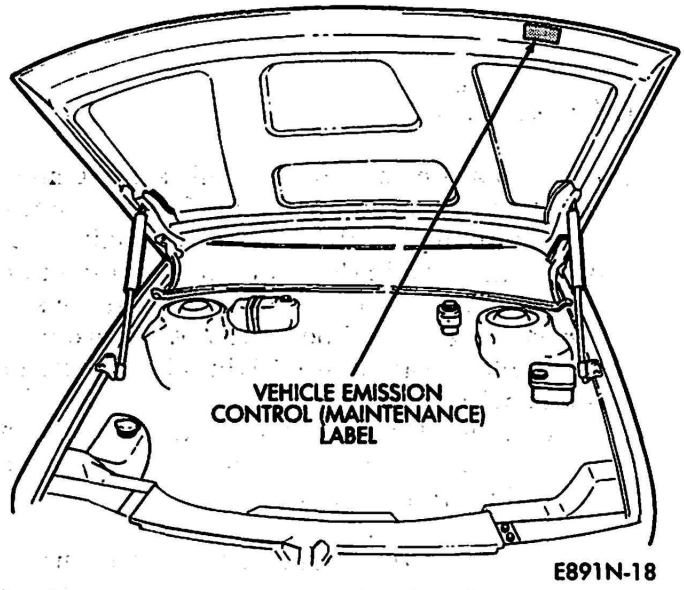


Fig. 2—Vehicle Emission Control (Maintenance) Label

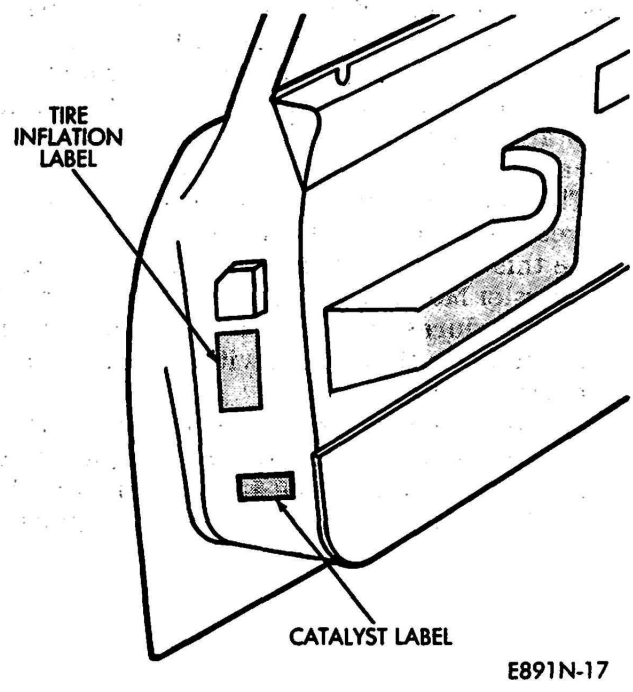


Fig. 3—Tire Inflation Pressures

VEHICLE IDENTIFICATION NUMBER (VIN)

The Vehicle Identification Number (VIN) is located on the left side of the instrument panel at the base of the windshield. All VIN's contain 17 characters in a combination of letters and numbers that provide specific information about the vehicle.

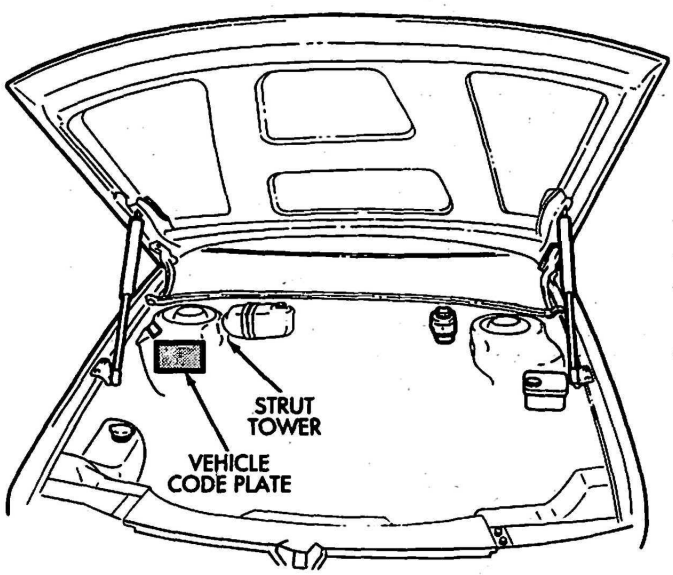
1990 V.I.N. CODE CHART

POSITION	CODE OPTIONS		INTERPRETATION
1	1 = United States	2 = Canada	Country
2	E = Eagle	B = Dodge	Make
3	3 = Passenger Car		Vehicle Type
4	A = Air Bag B = Manual Seat Belt C = Automatic Seat Belt	X = Driver Air Bag, Passenger Manual Seat Belt Y = Driver Air Bag, Passenger Automatic Seat Belt	Other
5	B = Dodge Monaco	B = Eagle Premier	Line
6	5 = Premium Line	6 = Special/Sport	Series
7	6 = 4 Dr. Sedan		Body
8	H = 2.5L Liter	U = 3.0 Liter	Engine
9*	(1 thru 9, 0 Orx)		Check Digit
10	L = 1990		Model Year
11	H = Bramalea		Assembly Plant
12 thru 17	(6 Digits)		Sequence Number

*Digit in Position 9 is used for V.I.N. Verification

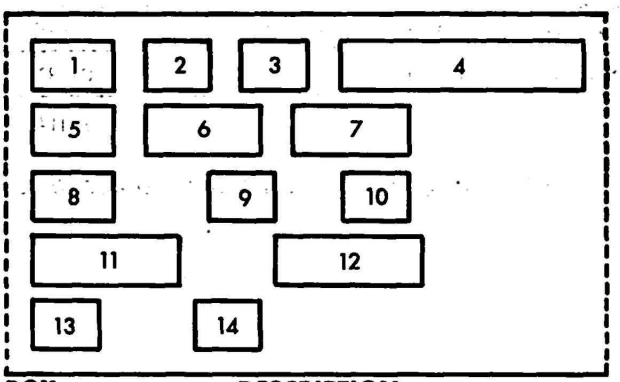
VEHICLE CODE PLATE

The vehicle code plate (Fig. 4) is located on top of the passenger side strut tower and states trim type, paint codes, engine type and transaxle type (Fig. 5).



E891N-20

Fig. 4—Vehicle Code Plate Location



BOX	DESCRIPTION
1.	PASSENGER CAR BUILT IN CANADA
2.	ENGINE TYPE/AUTOMATIC TRANSMISSION
3.	TRIM LEVEL (4-DOOR SEDAN)
4.	MODEL YEAR AND SERIAL NUMBER
5.	PRIMARY COLOR
6.	SECONDARY COLOR
7.	INTERIOR MATERIAL/COLOR
8.	AIR CONDITIONING
9.	CRUISE CONTROL
10.	REMOTE FUEL RELEASE
11.	FULL OR MINI CONSOLE
12.	POWER ANTENNA
13.	SUNROOF
14.	LUGGAGE RACK

901N-5

Fig. 5—Vehicle Code Plate

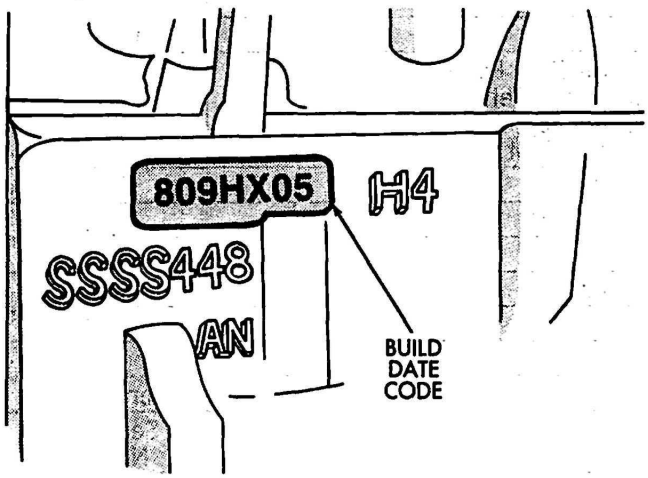
ENGINE BUILD DATE CODE

2.5L Engine

The engine build date code is located on a machined surface on the right side of the cylinder block between the No. 3 and No. 4 cylinders (Fig. 6).

The numbers of the code identify the year, month and day that the engine was built (Fig. 6).

The engines also have an additional number (consisting of the last 8 digits of the VIN) located on the right side of the engine above the build date code (Fig. 7).



1st Character (Year)	2nd and 3rd Characters (Month)	4th and 5th Characters (Engine Type)	6th and 7th Characters (Day)
8-1988	01-12	HX	01-31

E891N-22

Fig. 6—2.5L Engine Build Date Code & Location

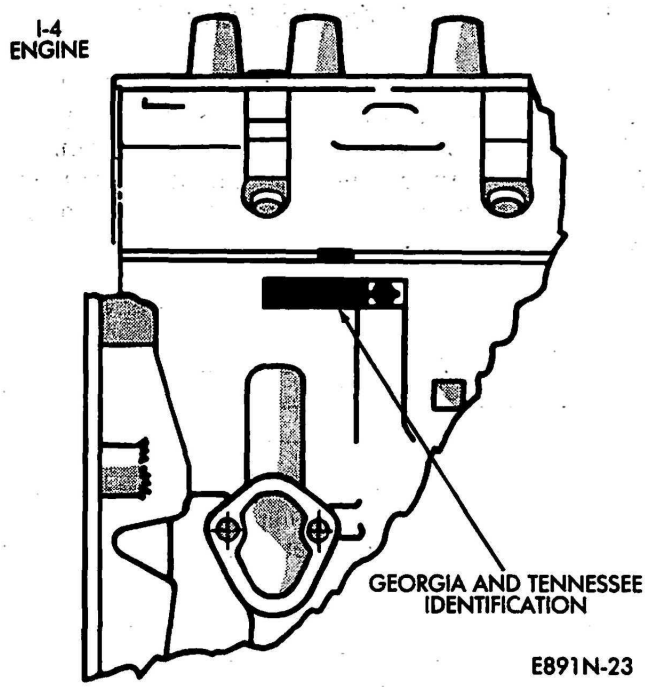


Fig. 7—Additional I.D. Number Location

3.0L Engine

The engine identification tag is attached to the right-hand side of the cylinder block below the exhaust manifold (Fig. 8).

The 1st six digits identify the engine type. The 2nd row of digits identify the numerical sequence in which the engine was built (Fig. 8).

The engines also have an additional number (consisting of the last 8 digits of the VIN) on the engine block as shown (Fig. 9).

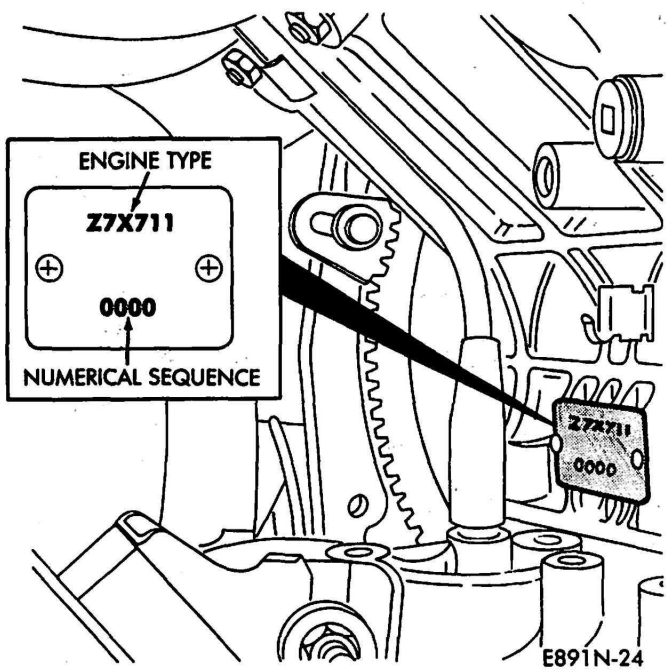


Fig. 8—3.0L Engine Build Date Code & Location

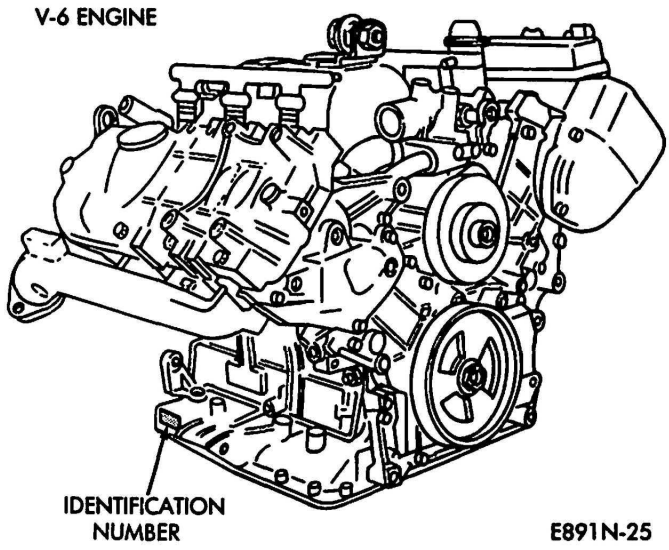


Fig. 9—Additional I.D. Number Location

TRANSAXLE IDENTIFICATION

AR-4 Transaxle

The transaxle identification tag is located next to the transaxle oil cooler on the passenger side of the case (Fig. 10). The information on the tag provides the transaxle type, suffix, fabrication number and plant of manufacture (Fig. 10).

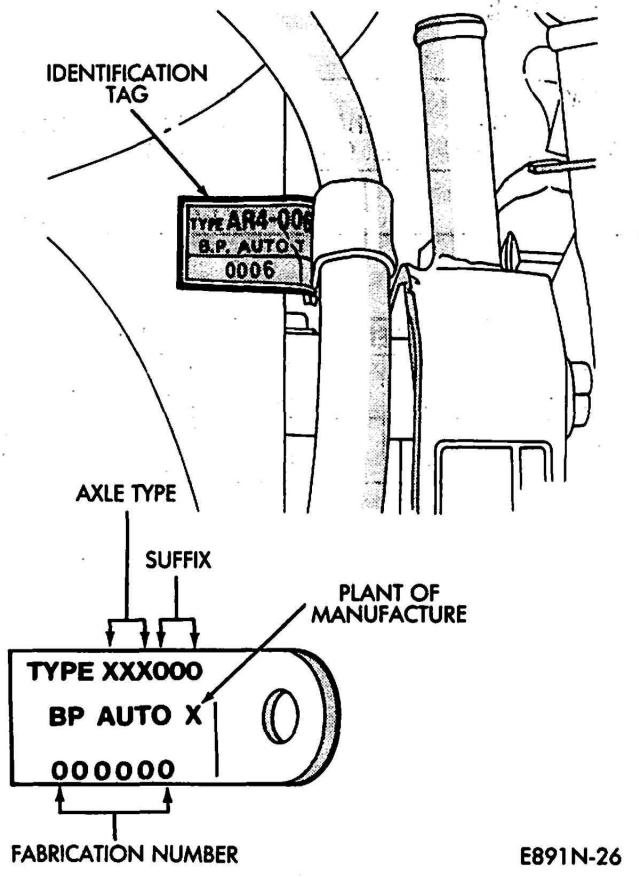


Fig. 10—AR-4 Transaxle Tag Location & Code

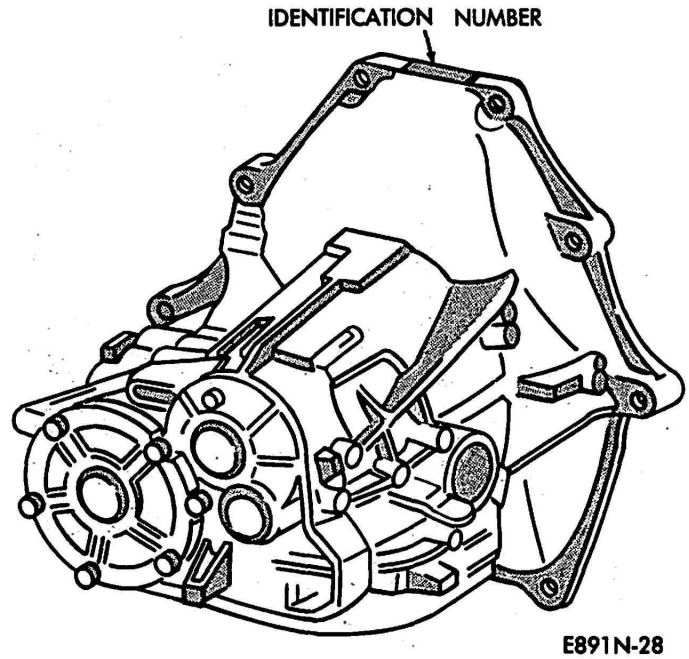


Fig. 11—Additional I.D. Number Location

Transaxles also have an additional number (consisting of the last 8 digits of the VIN) located on the upper edge of the bell housing (Fig. 11).

ZF Transaxle

The transaxle identification tag is on the left (driver) side of the case just above the oil pan (Fig. 12). The information on the plate consists of the build sequence number, manufacturers part number and the transaxle type (Fig. 12).

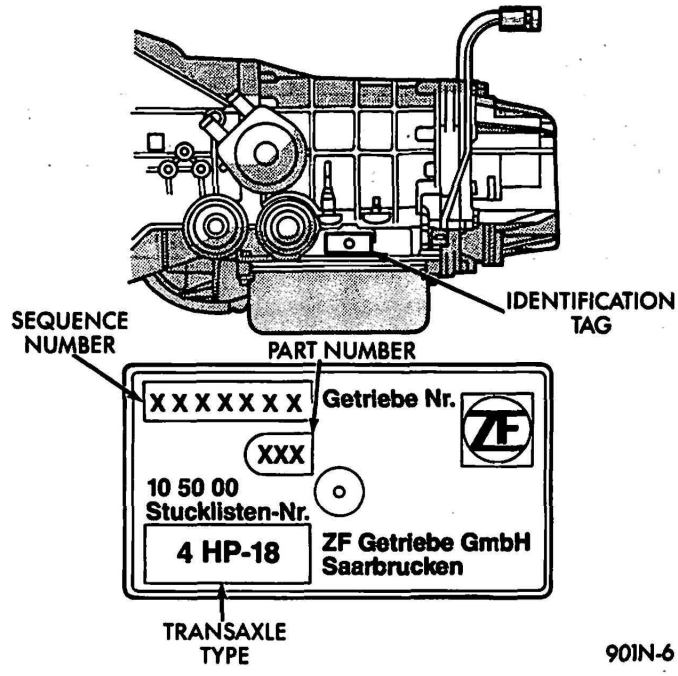


Fig. 12—ZF Transaxle Tag Location & Code

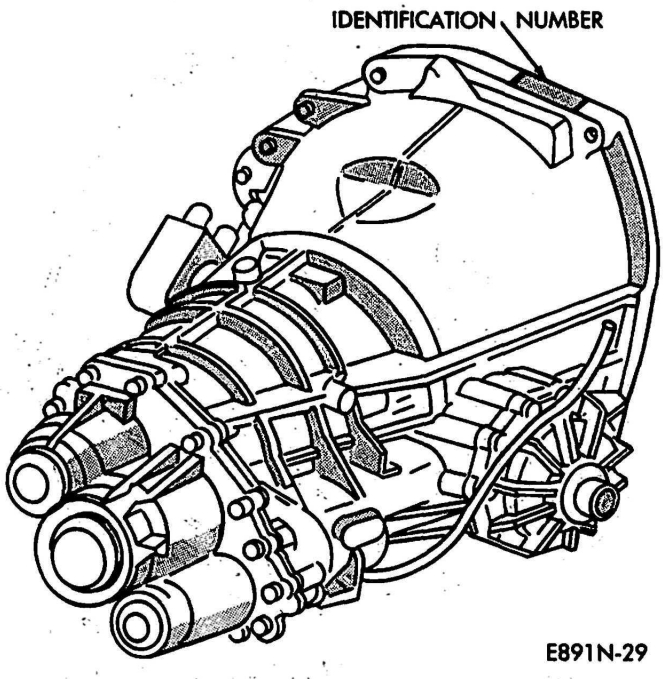


Fig. 13—Additional I.D. Number Location

Transaxles also have an additional number (consisting of the last 8 digits of the VIN) located on the upper edge of the bell housing (Fig. 13).

MAJOR DIMENSIONS

EXTERIOR

MODEL NAME	BODY TYPE	WHEEL BASE In. (mm)	TRACK FRONT In. (mm)	TRACK REAR In. (mm)	OVERALL LENGTH In. (mm)	OVERALL WIDTH In. (mm)	OVERALL HEIGHT In. (mm)
PREMIER	41	106.0 (2693)	58.1 (1477)	57.1 (1450)	192.8 (4897)	70 (1778)	54.7 (1389)

INTERIOR

MODEL NAME	BODY TYPE	HEAD ROOM FRONT In. (mm)	HEAD ROOM REAR In. (mm)	LEG ROOM FRONT In. (mm)	LEG ROOM REAR In. (mm)	SHOULDER ROOM FRONT In. (mm)	SHOULDER ROOM REAR In. (mm)	HIP ROOM FRONT In. (mm)	HIP ROOM REAR In. (mm)
PREMIER	41	38.5 (979)	37.5 (952)	43.8 (1112)	39.4 (1000)	57.8 (1469)	56.9 (1445)	54.8 (1392)	53.9 (1370)

TORQUE REFERENCES

Individual Torque Charts appear at the end of many Groups. Refer to the Standard Torque Specifications and Bolt Identification Chart in this Group for torques not listed in the individual torque charts (Fig. 14).

Note that the torque specifications given in the chart are based on the use of clean and dry threads. Reduce the torque by 10 percent when the threads are lubricated with engine oil and by 20 percent if new plated bolts are used.

BOLT TORQUE

BOLT SIZE	GRADE 5		GRADE 8	
	N·m	ft-lbs (in-lbs)	N·m	ft-lbs (in-lbs)
1/4-20	11	(95)	14	(125)
1/4-28	11	(95)	17	(150)
5/16-18	23	(200)	31	(270)
5/16-24	27	20	34	25
3/8-16	41	30	54	40
3/8-24	48	35	61	45
7/16-14	68	50	88	65
7/16-20	75	55	95	70
1/2-13	102	75	136	100
1/2-20	115	85	149	110
9/16-12	142	105	183	135
9/16-18	156	115	203	150
5/8-11	203	150	264	195
5/8-18	217	160	285	210
3/4-16	237	175	305	225

J89IN-9

Fig. 14—Grades 5 and 8 Standard Torque Specifications

METRIC THREAD AND GRADE IDENTIFICATION

Metric and SAE thread notations differ slightly. The difference is illustrated in Fig. 15.

Common metric fastener strength property classes are 9.8 and 12.9 with the class identification embossed on the head of each bolt (Fig. 16). Some metric nuts will be marked with single digit strength identification numbers on the nut face.

SAE strength classes range from grade 2 to 8 with line identification embossed on each bolt head. Markings corresponding to two lines less than the actual grade (Fig. 17). For Example - Grade 7 bolt will exhibit 5 embossed lines on the bolt head.

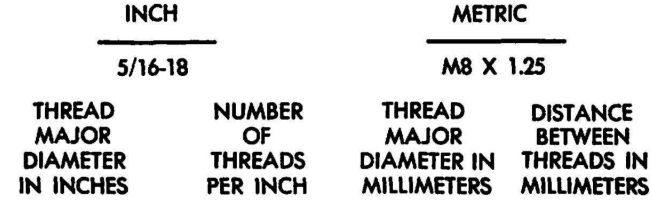
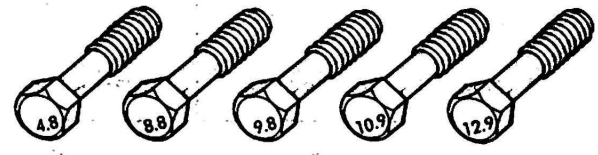


Fig. 15—Thread Notation (Metric and SAE)



METRIC BOLTS—IDENTIFICATION CLASS NUMBERS CORRESPOND TO BOLT STRENGTH— INCREASING NUMBERS REPRESENT INCREASING STRENGTH. J89IN-10

Fig. 16—Metric Bolt Identification

INTERNATIONAL SYMBOLS

Some of the International Symbols shown below are used to identify controls and displays in this vehicle. These symbols are applicable to those controls which are displayed on the instrument panel or in the immediate vicinity of the driver.

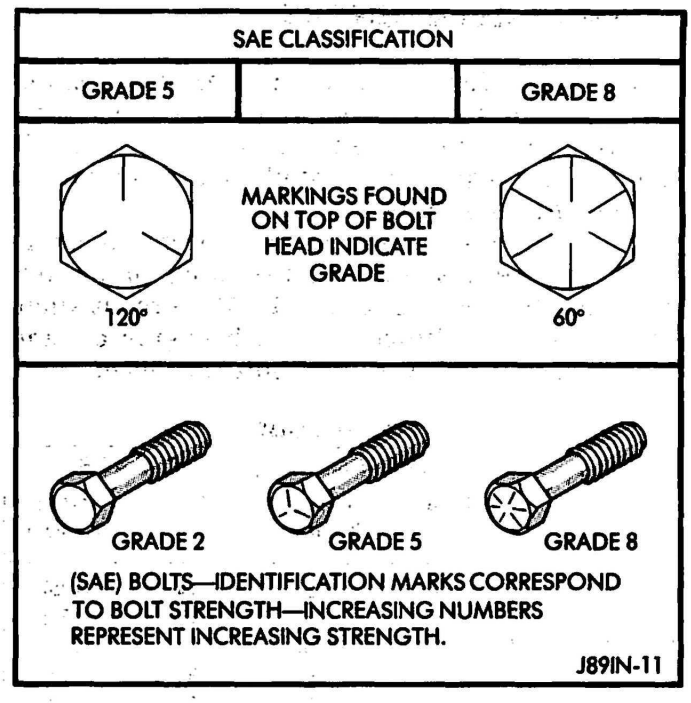


Fig. 17—SAE Bolt Identification

INTERNATIONAL SYMBOLS

UPPER BEAM	LOWER BEAM	TURN SIGNAL	HAZARD WARNING	WINDHIELD WIPER	WINDSHIELD WASHER
WINDSHIELD WIPER AND WASHER	VENTILATING FAN	PARKING LIGHTS	FRONT HOOD	REAR HOOD (TRUNK)	CHOKE (COLD STARTING AID)
HORN	FUEL	ENGINE COOLANT TEMPERATURE	BATTERY CHARGING CONDITION	ENGINE OIL	SEAT BELT
LIGHTER	REAR WINDOW WIPER	REAR WINDOW WASHER	PARKING BRAKE	BRAKE FAILURE	WINDSCREEN DEMISTING AND DEFROSTING

RK230

METRIC SYSTEM

Artwork, specifications, and tightening references in this Service Manual are identified in the metric system and in the SAE system.

During any maintenance or repair procedures, it is important to salvage metric fasteners (nuts, bolts, etc.) for reassembly. If the fastener is not salvageable, a fastener of equivalent specification should be used. **Use of an incorrect fastener may result in component damage or personal injury.**

The metric system is based on quantities of one, ten, one hundred, one thousand, and one million (Fig. 18).

The following Tables will assist you in conversion procedures.

Mega	-	(M) Million	Deci	-	(D) Tenth
Kilo	-	(K) Thousand	Centi	-	(C) Hundreth
			Milli	-	(m) Thousandth

J901N-2

Fig. 18—Metric Prefixes

Multiply	By	To Get	Multiply	By	To Get
in.-lbs.	x 0.11298	= Newton-Metres (N•m)	(N•m)	x 8.851	= in.-lbs.
ft.-lbs.	x 1.3558	= Newton-Metres (N•m)	(N•m)	x 0.7376	= ft.-lbs.
Inches Hg. (60°F)	x 3.377	= Kilopascals (kPa)	(kPa)	x 0.2961	= Inches Hg.
Pounds/Sq. In.	x 6.895	= Kilopascals (kPa)	(kPa)	x 0.145	= Pounds/Sq. In.
Inches	x 25.4	= Millimetres (mm)	(mm)	x 0.03937	= Inches
Feet	x 0.3048	= Metres (M)	(M)	x 3.281	= Feet
Yards	x 0.9144	= Metres (M)	(M)	x 1.0936	= Yards
Miles	x 1.6093	= Kilometres (Km)	(Km)	x 0.6214	= Miles
Miles/Hr.	x 1.6093	= Kilometres/Hr. (Km/h)	(Km/h)	x 0.6214	= Miles/Hr.
Feet/Sec.	x 0.3048	= Metres/Sec. (M/S)	(M/S)	x 3.281	= Feet/Sec.
Kilometres/Hr.	x 0.27778	= Metres/Sec. (M/S)	(M/S)	x 3.600	= Kilometres/Hr.
Miles/Hr.	x 0.4470	= Metres/Sec. (M/S)	(M/S)	x 2.237	= Miles/Hr.

COMMON METRIC EQUIVALENTS

1 Inch	= 25 Millimeters	1 Cubic Inch	= 16 Cubic Centimeters
1 Foot	= 0.3 Meter	1 Cubic Foot	= 0.03 Cubic Meter
1 Yard	= 0.9 Meter	1 Cubic Yard	= 0.8 Cubic Meter
1 Mile	= 1.6 Kilometers		

J901N-11

in-lbs to N•m

in- lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m
2	.2260	42	4.7453	82	9.2646	122	13.7839	162	18.3032
4	.4519	44	4.9713	84	9.4906	124	14.0099	164	18.5292
6	.6779	46	5.1972	86	9.7165	126	14.2359	166	18.7552
8	.9039	48	5.4232	88	9.9425	128	14.4618	168	18.9811
10	1.1298	50	5.6492	90	10.1685	130	14.6878	170	19.2071
12	1.3558	52	5.8751	92	10.3944	132	14.9138	172	19.4331
14	1.5818	54	6.1011	94	10.6204	134	15.1397	174	19.6590
16	1.8077	56	6.3270	96	10.8464	136	15.3657	176	19.8850
18	2.0337	58	6.5530	98	11.0723	138	15.5917	178	20.1110
20	2.2597	60	6.7790	100	11.2983	140	15.8176	180	20.3369
22	2.4856	62	7.0049	102	11.5243	142	16.0436	182	20.5629
24	2.7116	64	7.2309	104	11.7502	144	16.2696	184	20.7889
26	2.9376	66	7.4569	106	11.9762	146	16.4955	186	21.0148
28	3.1635	68	7.6828	108	12.2022	148	16.7215	188	21.2408
30	3.3895	70	7.9088	110	12.4281	150	16.9475	190	21.4668
32	3.6155	72	8.1348	112	12.6541	152	17.1734	192	21.6927
34	3.8414	74	8.3607	114	12.8801	154	17.3994	194	21.9187
36	4.0674	76	8.5867	116	13.1060	156	17.6253	196	22.1447
38	4.2934	78	8.8127	118	13.3320	158	17.8513	198	22.3706
40	4.5193	80	9.0386	120	13.5580	160	18.0773	200	22.5966

N•m to in-lbs

N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb
.2	1.7702	4.2	37.1747	8.2	72.5792	12.2	107.9837	16.2	143.3882
.4	3.5404	4.4	38.9449	8.4	74.3494	12.4	109.7539	16.4	145.1584
.6	5.3107	4.6	40.7152	8.6	76.1197	12.6	111.5242	16.6	146.9287
.8	7.0809	4.8	42.4854	8.8	77.8899	12.8	113.2944	16.8	148.6989
1	8.8511	5	44.2556	9	79.6601	13	115.0646	17	150.4691
1.2	10.6213	5.2	46.0258	9.2	81.4303	13.2	116.8348	17.2	152.2393
1.4	12.3916	5.4	47.7961	9.4	83.2006	13.4	118.6051	17.4	154.0096
1.6	14.1618	5.6	49.5663	9.6	84.9708	13.6	120.3753	17.6	155.7798
1.8	15.9320	5.8	51.3365	9.8	86.7410	13.8	122.1455	17.8	157.5500
2	17.7022	6	53.1067	10	88.5112	14	123.9157	18	159.3202
2.2	19.4725	6.2	54.8770	10.2	90.2815	14.2	125.6860	18.5	163.7458
2.4	21.2427	6.4	56.6472	10.4	92.0517	14.4	127.4562	19	168.1714
2.6	23.0129	6.6	58.4174	10.6	93.8219	14.6	129.2264	19.5	172.5970
2.8	24.7831	6.8	60.1876	10.8	95.5921	14.8	130.9966	20	177.0225
3	26.5534	7	61.9579	11	97.3624	15	132.7669	20.5	181.4480
3.2	28.3236	7.2	63.7281	11.2	99.1326	15.2	134.5371	21	185.8736
3.4	30.0938	7.4	65.4983	11.4	100.9028	15.4	136.3073	22	194.7247
3.6	31.8640	7.6	67.2685	11.6	102.6730	15.6	138.0775	23	203.5759
3.8	33.6342	7.8	69.0388	11.8	104.4433	15.8	139.8478	24	212.4270
4	35.4045	8	70.8090	12	106.2135	16	141.6180	25	221.2781

ft-lbs to N•m

ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m
1	1.3558	21	28.4722	41	55.5885	61	82.7049	81	109.8212
2	2.7116	22	29.8280	42	56.9444	62	84.0607	82	111.1770
3	4.0675	23	31.1838	43	58.3002	63	85.4165	83	112.5328
4	5.4233	24	32.5396	44	59.6560	64	86.7723	84	113.8888
5	6.7791	25	33.8954	45	61.0118	65	88.1281	85	115.2446
6	8.1349	26	35.2513	46	62.3676	66	89.4840	86	116.6004
7	9.4907	27	36.6071	47	63.7234	67	90.8398	87	117.9562
8	10.8465	28	37.9629	48	65.0793	68	92.1956	88	119.3120
9	12.2024	29	39.3187	49	66.4351	69	93.5514	89	120.6678
10	13.5582	30	40.6745	50	67.7909	70	94.9073	90	122.0236
11	14.9140	31	42.0304	51	69.1467	71	96.2631	91	123.3794
12	16.2698	32	43.3862	52	70.5025	72	97.6189	92	124.7352
13	17.6256	33	44.7420	53	71.8583	73	98.9747	93	126.0910
14	18.9815	34	46.0978	54	73.2142	74	100.3316	94	127.4468
15	20.3373	35	47.4536	55	74.5700	75	101.6862	95	128.8026
16	21.6931	36	48.8094	56	75.9258	76	103.0422	96	130.1586
17	23.0489	37	50.1653	57	77.2816	77	104.3980	97	131.5144
18	24.4047	38	51.5211	58	78.6374	78	105.7538	98	132.8702
19	25.7605	39	52.8769	59	79.9933	79	107.1196	99	134.2260
20	27.1164	40	54.2327	60	81.3491	80	108.4654	100	135.5820

N•m to ft-lbs

N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1	.7376	21	15.9888	41	30.2400	61	44.9913	81	59.7425
2	1.4751	22	16.2264	42	30.9776	62	45.7289	82	60.4801
3	2.2127	23	16.9639	43	31.7152	63	46.4664	83	61.2177
4	2.9502	24	17.7015	44	32.4527	64	47.2040	84	61.9552
5	3.6878	25	18.4391	45	33.1903	65	47.9415	85	62.6928
6	4.4254	26	19.1766	46	33.9279	66	48.6791	86	63.4303
7	5.1629	27	19.9142	47	34.6654	67	49.4167	87	64.1679
8	5.9005	28	20.6517	48	35.4030	68	50.1542	88	64.9545
9	6.6381	29	21.3893	49	36.1405	69	50.8918	89	65.6430
10	7.3756	30	22.1269	50	36.8781	70	51.6293	90	66.3806
11	8.1132	31	22.8644	51	37.6157	71	52.3669	91	67.1181
12	8.8507	32	23.6020	52	38.3532	72	53.1045	92	67.8557
13	9.5883	33	24.3395	53	39.0908	73	53.8420	93	68.5933
14	10.3259	34	25.0771	54	39.8284	74	54.5720	94	69.3308
15	11.0634	35	25.8147	55	40.5659	75	55.3172	95	70.0684
16	11.8010	36	26.5522	56	41.3035	76	56.0547	96	70.8060
17	12.5386	37	27.2898	57	42.0410	77	56.7923	97	71.5435
18	13.2761	38	28.0274	58	42.7786	78	57.5298	98	72.2811
19	14.0137	39	28.7649	59	43.5162	79	58.2674	99	73.0187
20	14.7512	40	29.5025	60	44.2537	80	59.0050	100	73.7562

in. to mm

in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
.01	.254	.21	5.334	.41	10.414	.61	15.494	.81	20.574
.02	.508	.22	5.588	.42	10.668	.62	15.748	.82	20.828
.03	.762	.23	5.842	.43	10.922	.63	16.002	.83	21.082
.04	1.016	.24	6.096	.44	11.176	.64	16.256	.84	21.336
.05	1.270	.25	6.350	.45	11.430	.65	16.510	.85	21.590
.06	1.524	.26	6.604	.46	11.684	.66	16.764	.86	21.844
.07	1.778	.27	6.858	.47	11.938	.67	17.018	.87	22.098
.08	2.032	.28	7.112	.48	12.192	.68	17.272	.88	22.352
.09	2.286	.29	7.366	.49	12.446	.69	17.526	.89	22.606
.10	2.540	.30	7.620	.50	12.700	.70	17.780	.90	22.860
.11	2.794	.31	7.874	.51	12.954	.71	18.034	.91	23.114
.12	3.048	.32	8.128	.52	13.208	.72	18.288	.92	23.368
.13	3.302	.33	8.382	.53	13.462	.73	18.542	.93	23.622
.14	3.556	.34	8.636	.54	13.716	.74	18.796	.94	23.876
.15	3.810	.35	8.890	.55	13.970	.75	19.050	.95	24.130
.16	4.064	.36	9.144	.56	14.224	.76	19.304	.96	24.384
.17	3.318	.37	9.398	.57	14.478	.77	19.558	.97	24.638
.18	4.572	.38	9.652	.58	14.732	.78	19.812	.98	24.892
.19	4.826	.39	9.906	.59	14.986	.79	20.066	.99	25.146
.20	5.080	.40	10.160	.60	15.240	.80	20.320	1.00	25.400

mm to in.

mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
.01	.00039	.21	.00827	.41	.01614	.61	.02402	.81	.03189
.02	.00079	.22	.00866	.42	.01654	.62	.02441	.82	.03228
.03	.00118	.23	.00906	.43	.01693	.63	.02480	.83	.03268
.04	.00157	.24	.00945	.44	.01732	.64	.02520	.84	.03307
.05	.00197	.25	.00984	.45	.01772	.65	.02559	.85	.03346
.06	.00236	.26	.01024	.46	.01811	.66	.02598	.86	.03386
.07	.00276	.27	.01063	.47	.01850	.67	.02638	.87	.03425
.08	.00315	.28	.01102	.48	.01890	.68	.02677	.88	.03465
.09	.00354	.29	.01142	.49	.01929	.69	.02717	.89	.03504
.10	.00394	.30	.01181	.50	.01969	.70	.02756	.90	.03543
.11	.00433	.31	.01220	.51	.02008	.71	.02795	.91	.03583
.12	.00472	.32	.01260	.52	.02047	.72	.02835	.92	.03622
.13	.00512	.33	.01299	.53	.02087	.73	.02874	.93	.03661
.14	.00551	.34	.01339	.54	.02126	.74	.02913	.94	.03701
.15	.00591	.35	.01378	.55	.02165	.75	.02953	.95	.03740
.16	.00630	.36	.01417	.56	.02205	.76	.02992	.96	.03780
.17	.00669	.37	.01457	.57	.02244	.77	.03032	.97	.03819
.18	.00709	.38	.01496	.58	.02283	.78	.03071	.98	.03858
.19	.00748	.39	.01535	.59	.02323	.79	.03110	.99	.03898
.20	.00787	.40	.01575	.60	.02362	.80	.03150	1.00	.03937

LUBRICATION AND MAINTENANCE

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GENERAL INFORMATION

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INTRODUCTION

Maintenance and lubrication service recommendations have been compiled to provide maximum protection for the owner's investment against all reasonable types of driving conditions.

Since these conditions vary with the individual operator's driving habits, the area in which the vehicle is operated and the type of service to which the vehicle is subjected, it is necessary to prescribe lubrication and maintenance service on a time schedule as well as mileage interval basis.

Additional information can be found in the Owner's Manual provided with the vehicle.

SERVICE PART RECOMMENDATIONS

Chrysler Motors has designed your vehicle to provide dependable service over a broad range of driving conditions. When service is required, Chrysler Motors recommends that on ONLY **MOPAR** brand parts, lubricants, and chemicals be used. MOPAR provides the best engineered products for servicing Chrysler Motors vehicles. Always insist on MOPAR brand products.

SEVERE SERVICE

If your vehicle is subjected to severe service operation, maintenance should be performed twice as frequently, for example, every 3½ months instead of every 7 months, or every 6000 km (3,750 miles) instead of every 12000 km (7,500 miles).

Severe service operation is defined as:

- Frequent starting and stopping.
- Frequent long periods of engine idling.
- Frequent short trips of less than 24 km (15 miles).
- Frequent driving in dusty conditions.
- Cold climate operation (–12°C or + 10°F or less).
- Sustained high speed operation (speeds over 112 km/h or 70 mph).
- Trailer towing.
- Commercial service.

FUEL USAGE

All engines require the use of unleaded fuel to reduce exhaust emissions, and to protect the catalytic converters. Use a fuel with a minimum octane rating of 87, (R + M)/2. Additional information can be found in Engine section of this group.

CLASSIFICATION OF LUBRICANTS

Oils, lubricants, and greases are classified and graded according to standards recommended by the Society of Automotive Engineers (SAE), American Petroleum Institute (API) and National Lubricating Grease Institute (NLGI).

Engine Oil

The SAE grade number indicates the viscosity of engine oils, for example, SAE 30, which is a single grade oil. Engine oils are also identified by a dual number, for example, SAE 5W-30, which indicates a multi-grade oil.

Gear Lubricants

The SAE grade number also indicates the viscosity of Multipurpose Gear Lubricants.

The API classification system defines gear lubricants in terms of usage such as API GL-4 or API GL-5, etc.

LUBRICATION AND MAINTENANCE SCHEDULES

SCHEDULED MAINTENANCE FOR EMISSION CONTROL AND VEHICLE PERFORMANCE
Inspection and service should be performed when malfunction is experienced or suspected.

SERVICE — Kilometers x 1000	12	24	36	48	60	72
Mileage x 1000	7.5	15	22.5	30	37.5	45
or Months	7	15	22	30	37	45
CHANGE ENGINE OIL	X	X	X	X	X	X
REPLACE ENGINE OIL FILTER	X	X	X	X	X	X
REPLACE ENGINE AIR FILTER				X		
INSPECT/ADJUST DRIVE BELTS Replace as Necessary				X		
REPLACE SPARK PLUGS Mileage Interval Only			X			

GENERAL MAINTENANCE

INSPECT BRAKE LININGS All Wheels — Replace as Necessary		X			X	
PACK REAR WHEEL BEARINGS			X			X
LUBRICATE TIE ROD ENDS Every 3 Years Or			X			
LUBRICATE BALL JOINTS Every 3 Years Or			X			
INSPECT CV JOINT BOOTS For Leaks	X	X	X	X	X	X
TEST AND INSPECT COOLING SYSTEM As Required or Every 12 Months						
FLUSH AND WINTERIZE COOLING SYSTEM			X At Start of Winter Afterwards			
INSPECT BRAKE HOSES For Leaks	X	X	X	X	X	X

Inspect Brake Hoses for Damage Every 12 Months or When Other Under Vehicle Service is Performed.

SEVERE SERVICE MAINTENANCE Driving in Stop/Go Conditions, Long Idling Periods, Frequent Short Trips, Operating at Sustained High Speeds in Temperatures Above 32°C (90°F).

Kilometers x 1000	4.8	9.6	14	19	24	29	34	38	43	48	53	58	62	67	72	77
Mileage x 1000	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48
CHANGE ENG. OIL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
REPLACE OIL FILTER	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
REPLACE AIR FILTER Inspect and Replace if Required					X					X					X	
INSPECT BALL JOINTS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
INSPECT CV JOINTS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CHANGE TRANS FLUID Adjust Bands at Time of Fluid and Filter Change					X					X					X	
LUBRICATE TIE ROD ENDS Every 18 Months or Mileage Specified					X					X					X	
INSPECT BRAKE LININGS All Wheels - Replace as Necessary			X			X			X			X			X	

SYSTEM	LITERS	QUARTS
ENGINE OIL		
2.5L Engine	4.7	5.0
3.0L Engine	5.7	6.0
COOLING SYSTEM		
2.5L/3.0L	8.2	8.6
TRANSAXLE		
AR-4/ZF	2.6	2.8
FUEL TANK		
Premier	64.4	17.0 (Gal.)

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Lubricants/Greases

Semisolid lubricants, bear the NLGI designation and are further classified as grades 0, 1, 2, 3, etc.

PARTS REQUIRING NO LUBRICATION

There are many points that should not be lubricated; some because they are permanently lubricated, some because lubricants will be detrimental to their operating characteristics, and some because lubricants will cause component failures. In particular, rubber bushings should not be lubricated since this not only will cause them to fail, but will destroy their necessary frictional characteristics. Parts that should not be lubricated are as follows:

- Air Pumps
- Alternator Bearings
- Drive Belts
- Fan Belt Idler Pulley
- Front Wheel Bearings
- Rubber Bushings
- Starter Bearings
- Suspension Strut Bearing
- Throttle Control Cable
- Throttle Linkage
- Water Pump Bearings

ASSIST (JUMP) STARTING

WARNING: DO NOT ATTEMPT TO PUSH OR TOW A VEHICLE TO GET IT STARTED. UNBURNED FUEL COULD ENTER THE CONVERTER AND, ONCE THE ENGINE HAS STARTED, IGNITE AND CAUSE THE CONVERTER TO OVERHEAT AND RUPTURE.

Booster Battery

WARNING: TO PREVENT PERSONAL INJURY OR DAMAGE TO CLOTHING, DO NOT ALLOW BATTERY FLUID TO CONTACT EYES, SKIN OR FABRICS. DO NOT LEAN OVER A BATTERY WHEN CONNECTING JUMPER CABLES OR ALLOW CABLE CLAMPS TO TOUCH EACH OTHER. KEEP OPEN FLAMES OR SPARKS AWAY FROM BATTERY VENT HOLES. ALWAYS WEAR EYE PROTECTION WHEN WORKING WITH BATTERIES.

If it becomes necessary to use a booster battery, with jumper cables, to start a vehicle's engine because its battery is discharged, the following procedure should be followed:

(1) Set parking brake and place automatic transaxle in "Park."

(2) Turn off the lights, heater, and other electrical loads.

(3) Raise the vent caps from the discharged battery using a flat, nonmetallic tool to remove the caps. It may be necessary to loosen the battery holddown clamp to remove the caps. Check fluid level. If low, fluid must be brought to the proper level before jump starting is attempted.

WARNING: WHEN TEMPERATURES ARE BELOW THE FREEZING POINT, ELECTROLYTE IN A DISCHARGED BATTERY MAY FREEZE. DO NOT ATTEMPT JUMP STARTING BECAUSE BATTERY COULD RUPTURE OR EXPLODE.

(4) Check the fluid condition. If slushy or frozen, battery must be brought up to 40°F (4°C) before it can be safely jump started or charged.

(5) Install vent caps on discharged battery vent wells. A relief valve in the cap prevents pressure build-up.

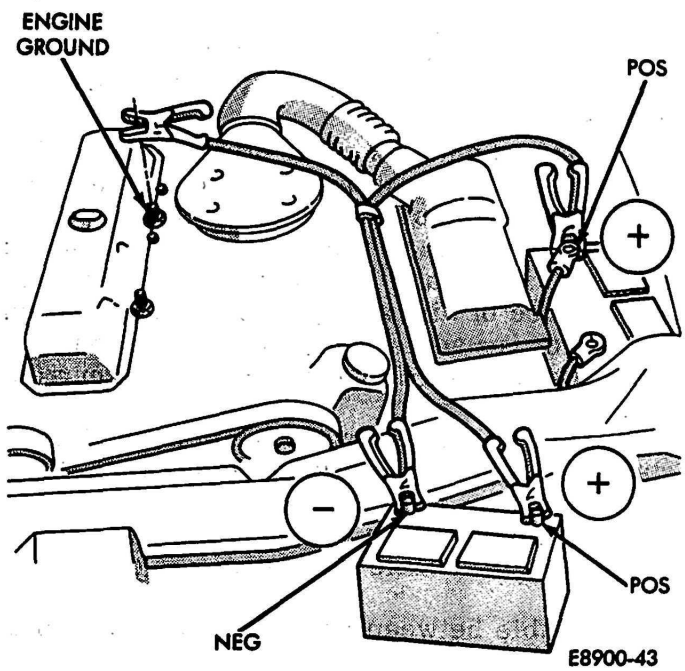


Fig. 1—Jumper Cable Hook-Up (2.5L)

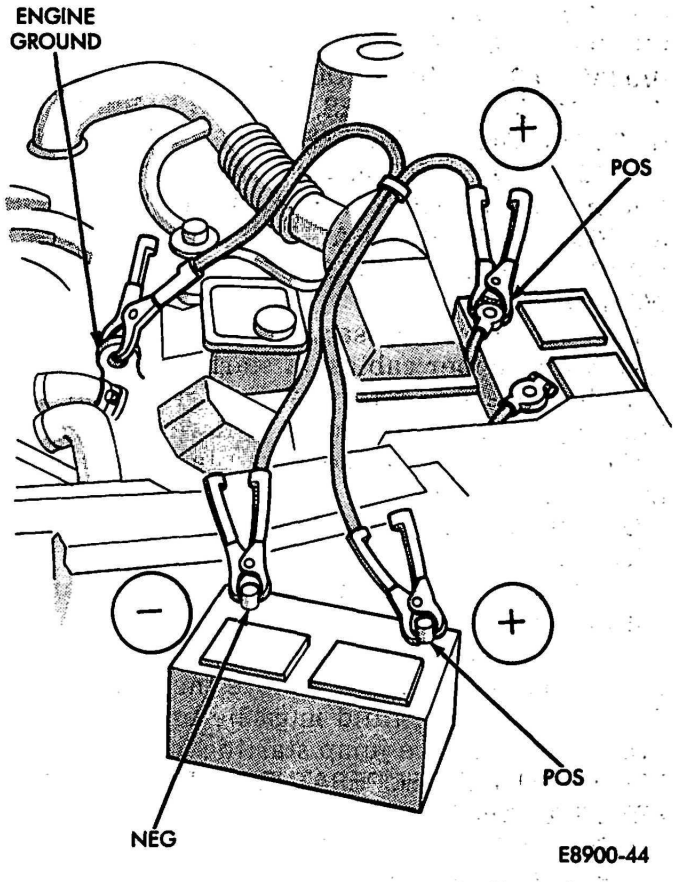


Fig. 2—Jumper Cable Hook-Up (3.0L)

CAUTION: Do not permit the vehicles to touch each other as this could establish a ground connection and counteract the benefits of this procedure.

(6) Attach one end of one jumper cable to the positive (+) terminal of the booster battery and other end of the same cable to the positive terminal of the discharged battery (Figs. 1 and 2).

WARNING: DO NOT CONNECT JUMPER CABLE TO THE NEGATIVE POST OF THE DISCHARGED BATTERY.

(7) Connect one end of the other jumper cable to the negative (–) terminal of the booster battery. Connect the other end of jumper cable to a good ground on the vehicle with the discharged battery (Figs. 1 and 2). Make sure the ground area is free of dirt and grease and that a good connection is made. The negative connection must provide good electrical conductivity and current carrying capacity.

(8) After engine is started or if engine fails to start, cables must be disconnected in the following order:

(a) Negative cable at engine ground.

(b) Negative cable at negative post on booster battery.

(c) Cable between positive post of both batteries.

WARNING: ANY PROCEDURE OTHER THAN THE ABOVE COULD RESULT IN:

1) PERSONAL INJURY CAUSED BY ELECTROLYTE SQUIRTING OUT BATTERY VENT.

2) PERSONAL INJURY OR PROPERTY DAMAGE DUE TO BATTERY EXPLOSION.

3) DAMAGE TO CHARGING SYSTEM OF BOOSTER VEHICLE OR OF IMMOBILIZED VEHICLE.

Portable Starting Unit

There are many types of these units available. Follow instructions of their manufacturer for necessary precautions and operations.

CAUTION: It is very important that their operating voltage does not exceed 15 volts because damage to battery, starter motor, alternator or electrical system may occur.

HOISTING RECOMMENDATIONS

Emergency Jacking

See the Owner's Manual for "Emergency Jacking" procedures.

Swing Arm Hoist

When using a (side type) swing arm hoist, position the pads of the hoist as shown Fig. 3.

CAUTION: Never let the hoist arms come into contact with the lower edge of the rocker panel.

If necessary, place a small block of wood between the hoist pad and the body at lifting points so that the vehicle will not rest on the rocker panels.

CAUTION: The use of a twin post under-the-vehicle hoist is not recommended.

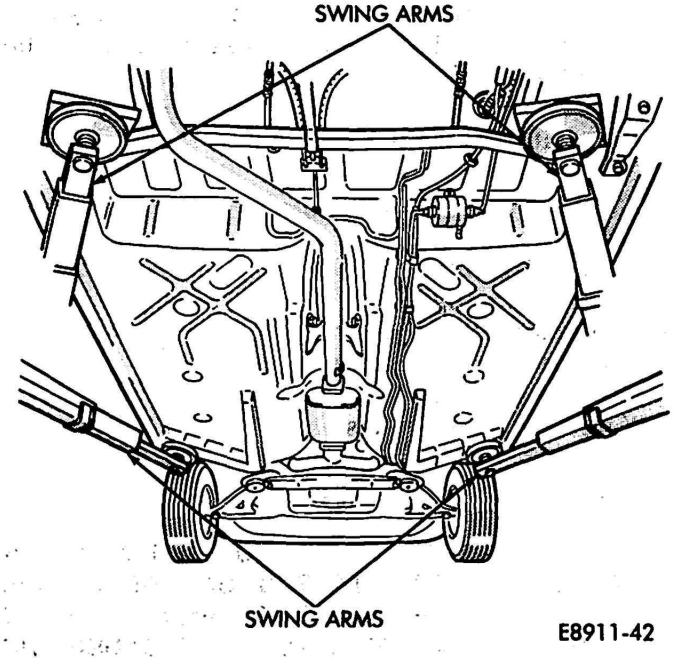


Fig. 3—Swing Arm Hoist

Supporting Vehicle Using Safety Stands

Apply the parking brake and/or block the wheels.

CAUTION: DO NOT place safety stands at locations other than the reinforced jacking points (Fig. 4). To do so may cause damage to the vehicle body.

Raise the vehicle at the lifting points (Fig. 3) using a hydraulic jack. Place a safety stand on the reinforced area of the rocker panel (Fig. 4).

When using "high stands", position stands as shown in Fig. 5.

Hydraulic Floor Jack

Rear of Vehicle

CAUTION: Never use the rear axle "V" shaped section as a lifting point. The "V" shaped section and torsion bars could be damaged by the jack.

Refer to "Supporting Vehicle Using Safety Stands" for lifting instructions.

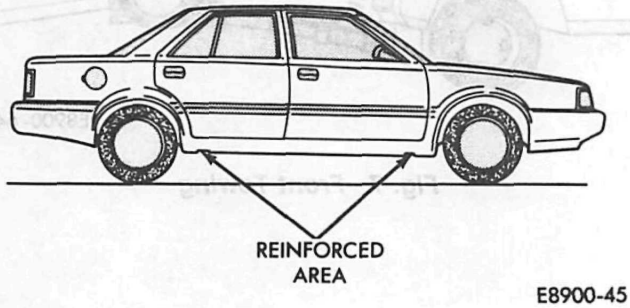
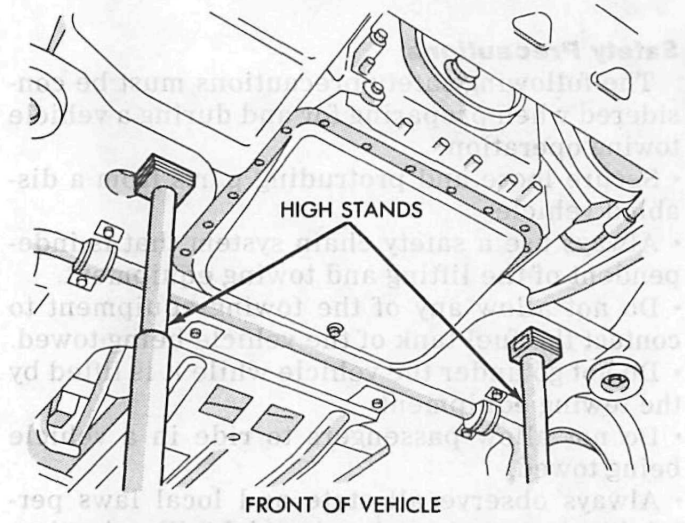


Fig. 4—Reinforced Area for Safety Stands



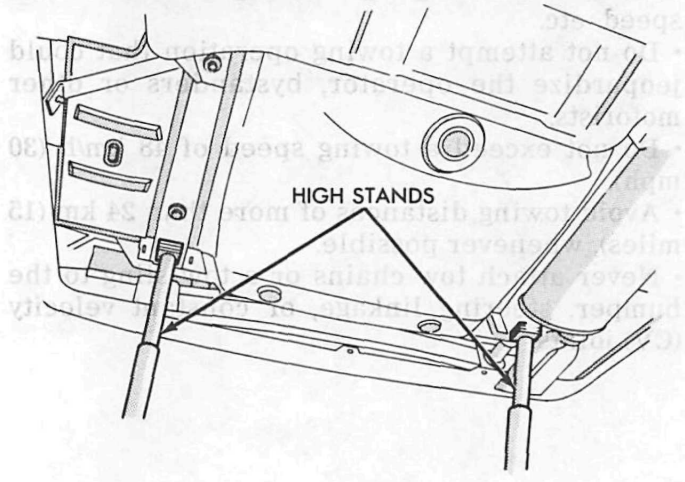


Fig. 5—Position of High Stands

Front of Vehicle

CAUTION: Never use the front suspension lower control arms as lifting points. The lower control arms could be damaged by the jack.

Apply the parking brake and/or block the rear wheels.

WARNING: NEVER SUPPORT THE WEIGHT OF A VEHICLE DIRECTLY ON THE LOWER SILL OF THE ROCKER PANEL.

Place a piece of 2″ × 4″ × 27″ wood on the hydraulic floor jack beneath the front sill (Fig. 6). This will spread the load.

Raise the front of the vehicle.

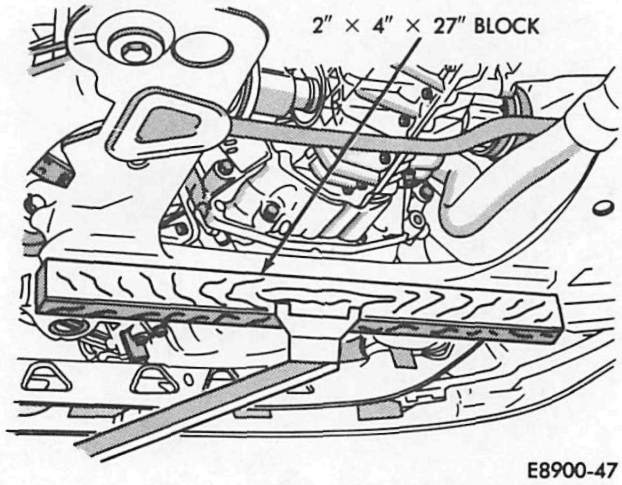


Fig. 6—Wood Support Beneath Front Sill

TOWING RECOMMENDATIONS

Safety Precautions

The following safety precautions must be considered when preparing for and during a vehicle towing operation:

- Secure loose and protruding parts from a disabled vehicle.
- Always use a safety chain system that is independent of the lifting and towing equipment.
- Do not allow any of the towing equipment to contact the fuel tank of the vehicle being towed.
- Do not go under the vehicle while it is lifted by the towing equipment.
- Do not allow passengers to ride in a vehicle being towed.
- Always observe all state and local laws pertaining to warning signals, night illumination, speed, etc.
- Do not attempt a towing operation that could jeopardize the operator, bystanders or other motorists.
- Do not exceed a towing speed of 48 km/h (30 mph).
- Avoid towing distances of more than 24 km (15 miles), whenever possible.
- Never attach tow chains or a tow sling to the bumper, steering linkage, or constant velocity (CV) joints.

Front Towing Procedures

CAUTION: Do Not attempt to tow the vehicle from the front with sling type towing equipment. Damage to the bumper facia will result.

Always tow the vehicle with the front wheels off the ground as shown in Fig. 7.

The only other method of approved towing is with a flat bed tow truck.

Rear Towing Procedures

CAUTION: DO NOT tow the vehicle from the rear.

If damage to the vehicle prevents front towing, move the vehicle onto a flat bed tow truck.

CAUTION: Do not push the vehicle with another vehicle as damage to the bumper facia and transaxle may result.

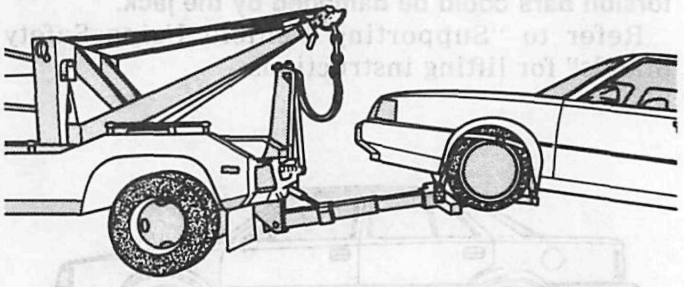


Fig. 7—Front Towing

ENGINE

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ENGINE OIL

During Break-In

After starting a cold engine, let it warm up for 15 seconds or so before shifting into gear.

Drive at varying speeds below 90 km/h (55 mph) for the first 970 km (600 miles). Use the proper gear for your speed range. Drive at maximum legal speed only when the engine has reached normal operating temperature. Avoid driving at full throttle or top speed, steady speeds, or excessive idling during this period. Avoid fast starts and quick stops. Do not tow a trailer during break-in.

A break-in oil is not used. The original engine oil is the same type specified for regular oil changes. There is no need to have it changed or the oil filter replaced until the first scheduled maintenance interval, except for severe service operation. Don't add anti-friction compounds or special break-in oils during the first few thousand kilometers (or miles) of operation, since these additives might interfere with proper piston ring seating.

Check the fluid and engine oil levels regularly and be alert for indications of overheating in any component of the vehicle. Engines tend to use more fuel and oil until they are broken in, so don't expect top economy for the first 3200 to 4800 km (2,000 to 3,000 miles).

Allow proper break-in, at least 3200 to 4800 km (2,000 to 3,000 miles), before requesting engine adjustments, if needed.

Selecting Engine Oil

For best performance and to provide for maximum protection for all engines under all types of operation, only those lubricants should be selected which:

(1) Conform to the API quality "SG."

(2) Have the proper SAE grade number for the expected ambient temperature range (Fig. 1).

To assure use of properly formulated engine oils, it is recommended that MOPAR oils, or an equivalent that meets Chrysler Material Standard MS-6395, be used.

Lubricants not having both an SAE grade number and the proper API service classification shown on the container **should not** be used.

Low viscosity oils make engine starting easier in cold weather. As stated in the chart (Fig. 1), oils of the SAE 5W-30 grade number are preferred when minimum temperature consistently fall below -12°C (+10°F).

Engine Oil Identification Logo

A logo or symbol has been developed to aid the vehicle owner in the proper selection of engine oil.

This logo is located on the oil container and is composed of three distinct areas for identifying various aspects of the oil (Fig. 2).

(1) The top portion will indicate the quality of the oil, such as "SG" or "SG/CD."

(2) The center portion, to be used by most oil marketers, will show the SAE viscosity grade of the oil, such as SAE 5W-30.

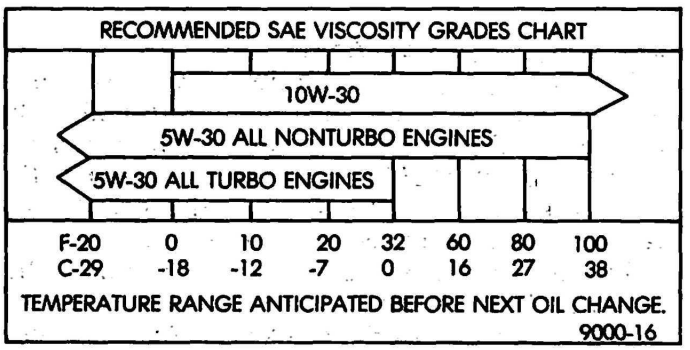


Fig. 1—Recommended Viscosity Grades

(3) The lower portion will state "ENERGY CONSERVING," if it is applicable to that oil. Energy conserving when shown, indicates, that oil, offers fuel economy benefits in gasoline engines.

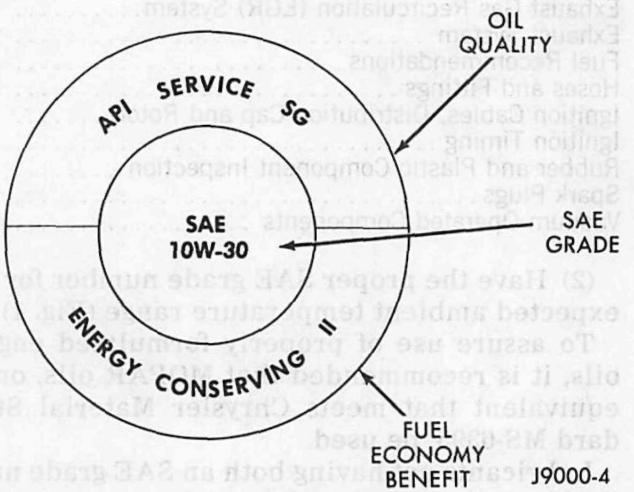


Fig. 2—Oil Container Logo (Typical)

Energy Conserving Engine Oils

There are many engine oils currently available that could increase the fuel economy of your vehicle. They are marketed as "ENERGY CONSERVING", "FUEL SAVING", "FUEL EFFICIENT", "GAS SAVING", etc . . .

Oils of this type are now identified on the lower portion of the new engine oil identification logo described above.

In addition to selecting the proper API quality classification and SAE viscosity grade, use of energy conserving type engine oil formulation is recommended.

Engine Oil Level Indicator

The engine oil level indicator, "dipstick", is located on the right rear of the 2.5L engine (Fig. 3) and the right side of the 3.0L engine (Fig. 4).

Checking Engine Oil Level

To assure proper lubrication of your vehicle's engine, the engine oil must be maintained at the correct level. The correct level is between the "ADD" and "FULL" marks on the engine dipstick (Figs. 3 and 4). Check the oil level at regular intervals, such as every fuel stop. Add oil only when the level on the dipstick is at or below the "ADD" mark.

CAUTION: Do not overfill crankcase. This will cause oil aeration and loss of oil pressure.

Materials Added to Engine Oils

It is not necessary to add any material to crankcase oils for most types of vehicle operation. In some instances, such as infrequent operation or short trips only and during break-in after a major engine overhaul and/or new piston installation, addition of special materials containing anti-rust and anti-scuff additives are beneficial. MOPAR Engine Oil Supplement, or equivalent, is a suitable product for this purpose.

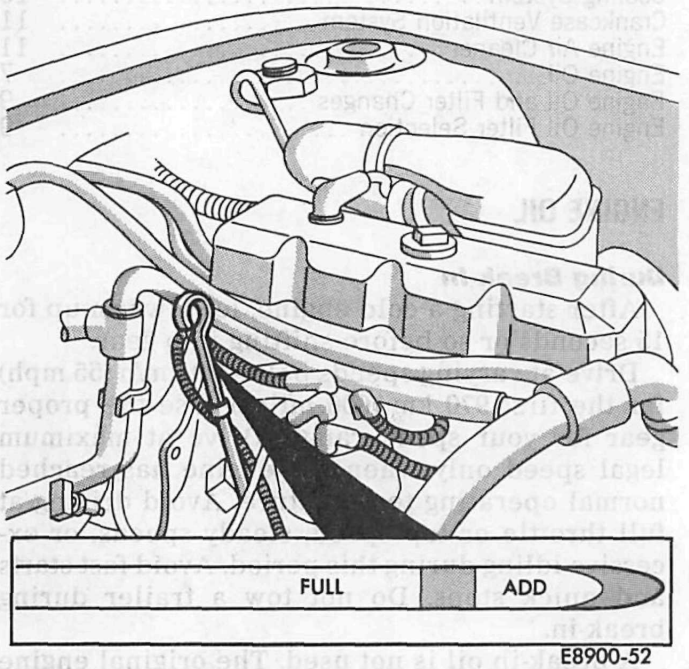


Fig. 3—Dipstick Location (2.5L Engine)

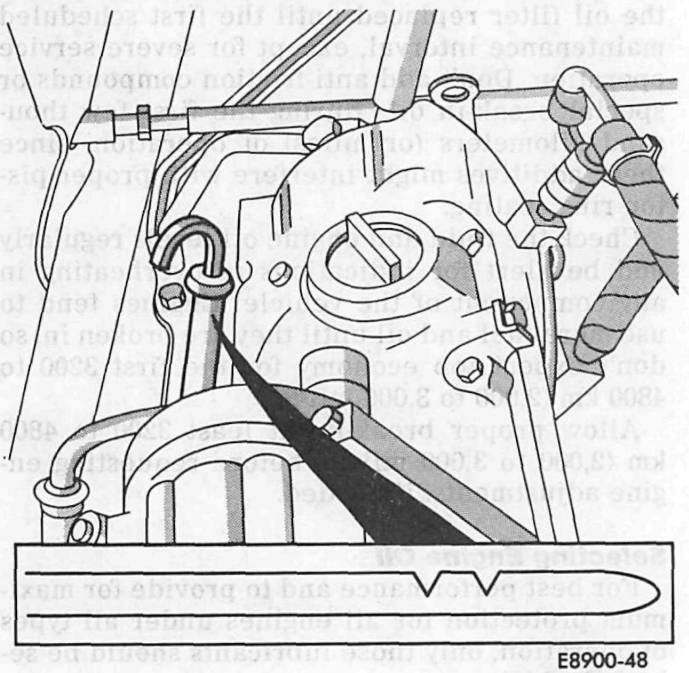


Fig. 4—Dipstick Location (3.0L Engine)

ENGINE OIL FILTER SELECTION

All engines are equipped with full-flow, throw-away oil filters. The same type of replacement filter, depending on engine size is recommended as a replacement filter in service on these vehicles.

The quality of replacement filters varies considerably. Be sure that any replacement oil filter used is a high quality filter, and is capable of withstanding pressure of 1764 kPa (256 psi)—manufacturer's specification—to avoid filter and engine damage.

ENGINE OIL AND FILTER CHANGES

Oil and Filter Changes

WARNING: TEST RESULTS SUBMITTED TO EPA HAVE SHOWN THAT LABORATORY ANIMALS DEVELOP SKIN CANCER AFTER PROLONGED CONTACT WITH USED ENGINE OIL. ACCORDINGLY, THE POTENTIAL EXISTS FOR HUMANS TO DEVELOP A NUMBER OF SKIN DISORDERS, INCLUDING CANCER, FROM SUCH EXPOSURE TO USED ENGINE OIL. CARE SHOULD BE TAKEN WHEN CHANGING ENGINE OIL, TO MINIMIZE THE AMOUNT AND LENGTH OF EXPOSURE TIME TO USED ENGINE OIL ON YOUR SKIN. PROTECTIVE CLOTHING AND GLOVES, THAT CANNOT BE PENETRATED BY OIL, SHOULD BE WORN, THE SKIN SHOULD BE THOROUGHLY WASHED WITH SOAP AND WATER, OR USE WATERLESS HAND CLEANER, TO REMOVE ANY USED ENGINE OIL. DO NOT USE GASOLINE, THINNER, OR SOLVENTS.

Engine oil should be changed at the following intervals:

(1) Every 12000 km (7,500 mile) or 7 month intervals, whichever occurs first. If the vehicle is driven under severe service conditions, every 6000 km (3,750 mile) or 3½ month intervals, whichever occurs first.

(2) Drain the crankcase only after the engine has reached the normal operating temperature to ensure complete drainage of the used oil.

(3) Install the drain plug with a new gasket (Fig. 5). Torque the drain plug to 34 N·m (25 ft-lbs) torque (2.5L) or 30 N·m (22 ft-lbs) torque (3.0L).

(4) The oil filter should be changed at every engine oil change. Change the oil filter as follows:

(a) Turn the filter counterclockwise to remove (Figs. 6 and 7).

(b) Clean the engine block filter mount.

(c) Lightly coat the rubber seal on the filter with engine oil.

(d) **Hand tighten only.** Tighten the filter down and then loosen it. Now tighten the filter ½ to ¾ of a turn clockwise past the point of gasket contact with the engine mount.

CAUTION: The engine oil filter mount has metric threads. Use of a filter with improper threads can result in oil leakage and possible engine damage. Look for the symbol "M20 × 1.5" on the filter.

(6) Add oil at the filler hole on top of the engine (Figs. 8 and 9). Keep the engine clean by wiping up any spilled oil.

CAUTION: Do not overfill the crankcase. This will cause oil aeration and loss of oil pressure.

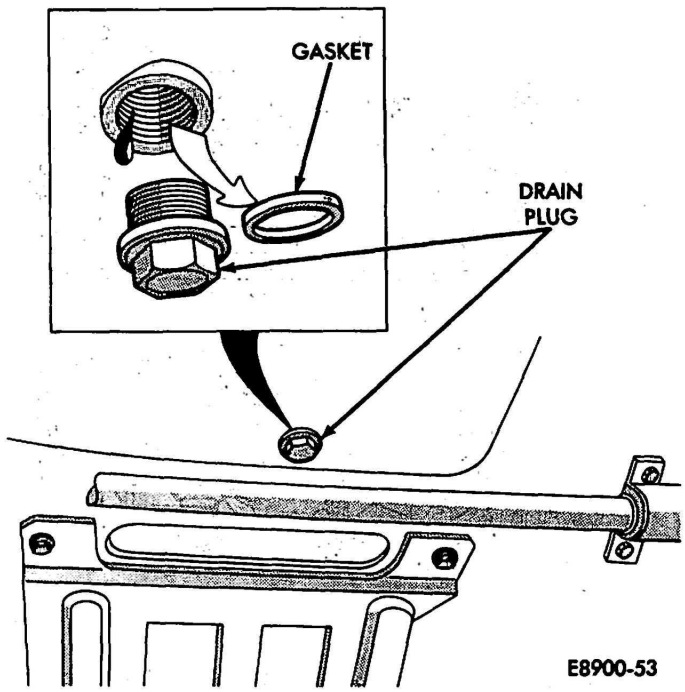


Fig. 5—Drain Plug and Gasket

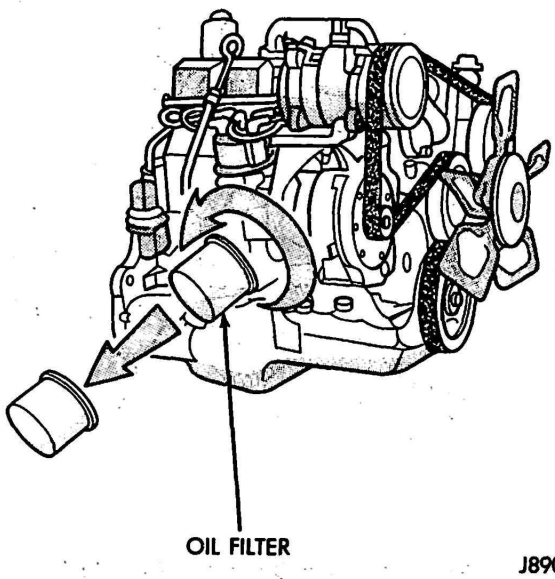


Fig. 6—Oil Filter Removal/Installation (2.5L Engine)

Disposing of Used Engine Oil

Care should be taken in disposing of the used engine oil from your vehicle. See WARNING above. Used oil, indiscriminately discarded, can present a problem to the environment. Contact your dealer or service station to find out where used oil can be safely discarded in your area.

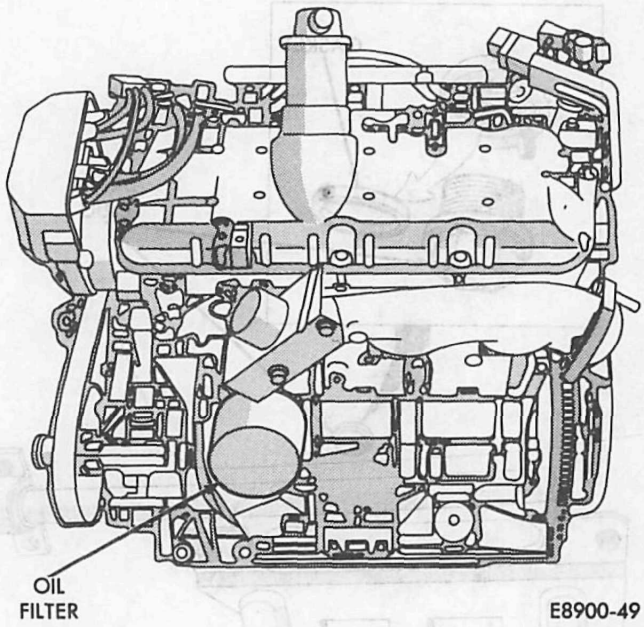


Fig. 7—Oil Filter Removal/Installation (3.0L Engine)

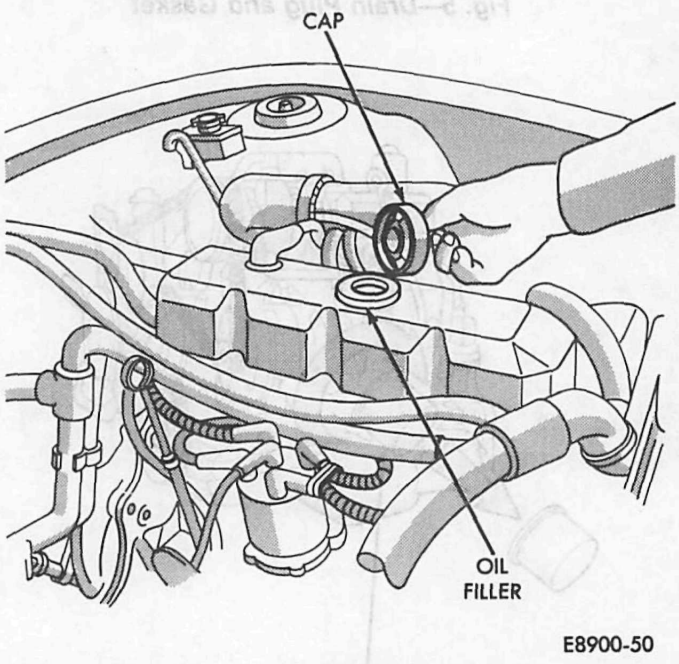


Fig. 8—Adding Oil to Engine (2.5L)

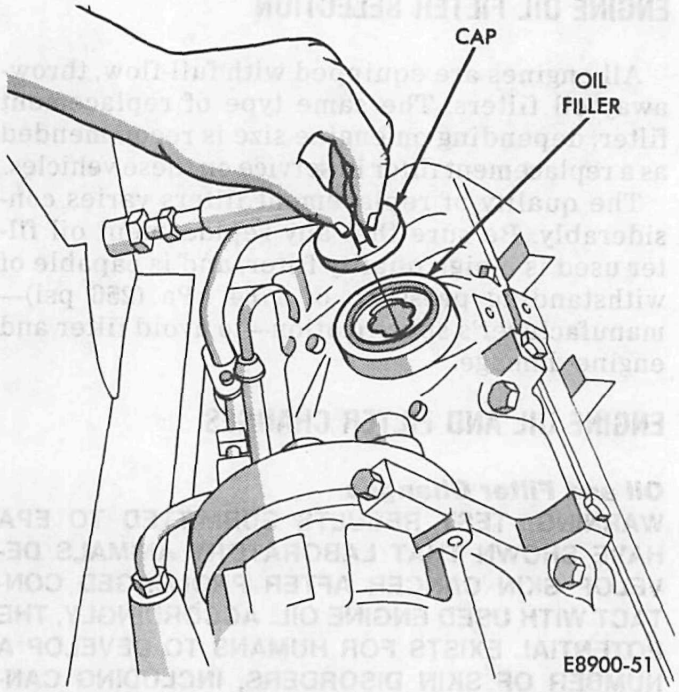


Fig. 9—Adding Oil to Engine (3.0L)

COOLING SYSTEM

WARNING: TAKE CARE TO AVOID THE RADIATOR COOLING FAN WHENEVER THE VEHICLE HOOD IS RAISED.

Inspection

With the engine cold, check the coolant level in the coolant reserve bottle every 12000 km (7,500 mile) or 7 month intervals. Add coolant to the coolant reserve bottle, if necessary.

WARNING: WHEN REMOVING THE RADIATOR CAP, CARE SHOULD BE TAKEN TO PREVENT SCALDING FROM HOT PRESSURIZED COOLANT.

Coolant protection checks should be made every 12 months (prior to the onset of freezing weather, where applicable). If coolant is dirty or rusty in appearance, the system should be drained, flushed and filled with fresh coolant.

Check radiator cap for proper vacuum sealing and operation. Use caution when removing the radiator cap to avoid contact with hot coolant or steam. Place a heavy rag or towel over the cap and turn to the first stop. Do not press down. Pause to allow pressure to release through the overflow tube, then press down and turn counterclockwise to remove cap. Check face of radiator and air conditioning condenser for any accumulation of bugs, leaves, etc. Check reserve tank tubing for condition and tightness of connection at coolant reserve bottle and radiator. Inspect entire system for leaks.

Your cooling system has a 50/50 solution of antifreeze and water from the factory. This is the

recommended solution for most operating temperatures and provides good corrosion protection.

Failure to follow anti-freeze concentration and replacement recommendations or failure to use antifreeze formulated to prevent corrosion of all cooling system metals, may result in radiator plugging. The result is engine overheating or cooling system leaks, such as at core hole plugs, resulting in loss of coolant.

Radiator Cap

The radiator cap must be fully tightened in order to provide a good seal with the radiator filler neck. This prevents loss of coolant and ensures that coolant will return to the radiator from the coolant reserve bottle. The vent valve and its seat can become contaminated with coolant sediment, etc. The valve and seat should be carefully cleaned if:

(1) The system will not go under pressure.

(2) The coolant reserve bottle gains coolant abnormally.

(3) The top radiator hose collapses on cooldown.

Drain, Flush, and Fill

WARNING: DO NOT OPEN ENGINE BLOCK DRAIN WHEN SYSTEM IS HOT AND UNDER PRESSURE AS SERIOUS BURNS FROM COOLANT MAY OCCUR.

Drain, flush, and fill the cooling system at the mileage or time intervals specified in the "Maintenance Schedule" in this Group. If the solution is dirty or rusty or contains a considerable amount of sediment, clean and flush with a reliable cooling system cleaner. Refer to Group 7, "Cooling System" for the proper procedure.

HOSES AND FITTINGS

Inspect the hose fittings for looseness and corrosion. Inspect the hoses for brittleness and cracks.

Thoroughly inspect the hose ends that are slipped onto nipples.

Engine performance may be adversely affected by air leaks into such unlikely places as the heater and air conditioner control vacuum hoses, coolant hoses or the power brake booster vacuum hose.

ENGINE AIR CLEANER

The engine air cleaner filter element should be replaced every 48000 km (30,000 mile) or 30 month intervals under normal driving conditions. When the vehicle is frequently operated in dusty conditions, the filter element should be replaced every 24000 km (15,000 mile) or 15 month intervals.

Service

(1) Remove the air cleaner cover.

(2) Remove the air cleaner filter element (Fig. 10).

(3) Clean the filter element by blowing dirt out gently with compressed air. Direct the air in the opposite direction of the normal air flow keeping the nozzle two inches away from the element to avoid damage.

(4) If the filter element is ½ saturated with oil, replace the element and check the crankcase ventilating system for proper operation.

CAUTION: Do not tap or immerse the paper filter element in liquid.

(5) Wash the air cleaner cover and body with cleaning solvent and wipe dry.

(6) Install the paper filter element and attach the cover.

CRANKCASE VENTILATION SYSTEM

All models with gasoline operated engines are equipped with a closed crankcase ventilation system designed to eliminate emission of residual fumes and vapors from the crankcase by directing these fumes back through the engine combustion chamber.

Ventilation System Operation

2.5L Engine

The crankcase ventilation (CCV) system mixes crankcase vapors and fresh air in the cylinder head cover. The fresh air is drawn into the cylin-

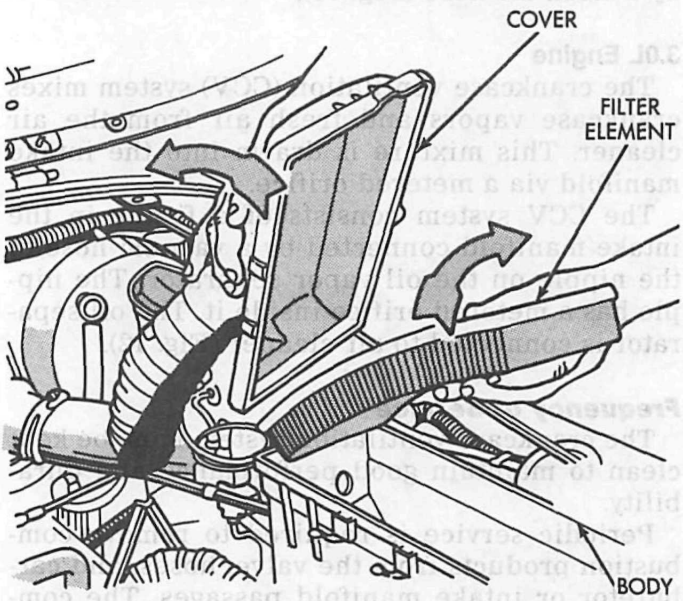


Fig. 10—Air Cleaner (Typical)

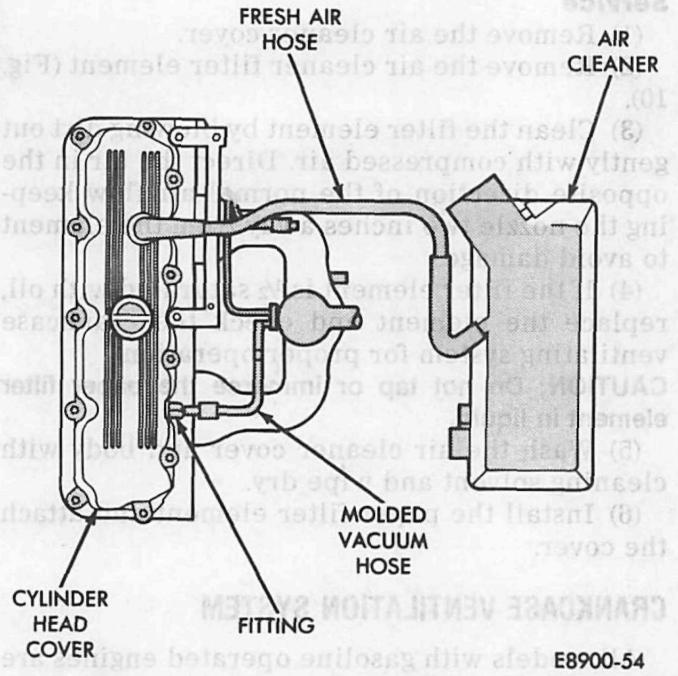


Fig. 11—Crankcase Ventilation (2.5L)

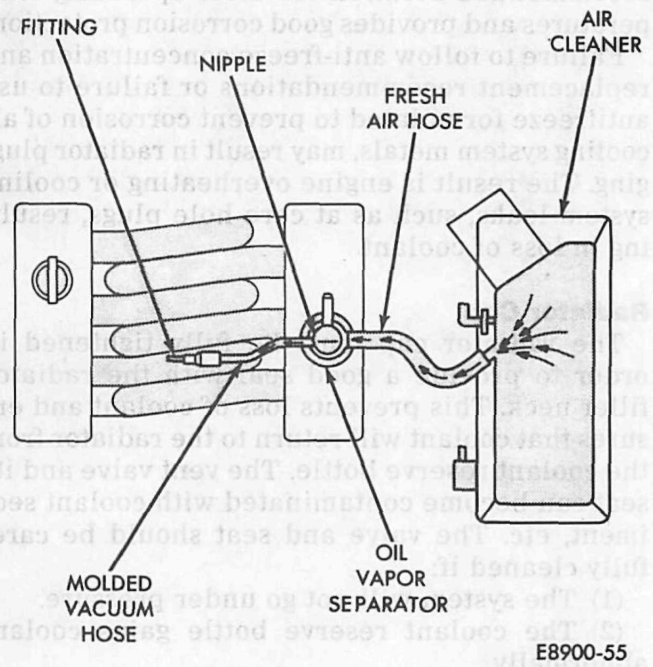


Fig. 12—Crankcase Ventilation (3.0L)

der head cover from the air cleaner. This mixture is then drawn into the intake manifold via a metered orifice inside a fitting at the cylinder head cover.

The CCV system consists of a fitting with a metered orifice inside it that is connected to the cylinder head cover. A molded vacuum hose connects the intake manifold to this fitting. The air cleaner is connected to the cylinder head cover by a fresh air hose (Fig. 11).

3.0L Engine

The crankcase ventilation (CCV) system mixes crankcase vapors and fresh air from the air cleaner. This mixture is drawn into the intake manifold via a metered orifice.

The CCV system consists of a fitting in the intake manifold connected by a vacuum hose to the nipple on the oil vapor separator. The nipple has a metered orifice inside it. The oil separator is connected to air cleaner (Fig. 12).

Frequency of Service

The crankcase ventilation system must be kept clean to maintain good performance and durability.

Periodic service is required to remove combustion products from the valve, hoses, and carburetor or intake manifold passages. The components should be inspected and serviced at the mileage or time intervals specified in the "Maintenance Schedule" in this Group. If a vehicle is used excessively for short trips with frequent idling, the crankcase ventilation system may require servicing more frequently.

Inspection and Service Procedure

(1) With the engine running, remove the CCV fitting.

(a) If the fitting is not plugged, a hissing noise will be heard as air passes through the valve. A strong vacuum should also be felt when a finger is placed over the fitting.

(b) Install the CCV fitting.

(c) Remove the fresh air hose from the air cleaner assembly and loosely hold a piece of paper over the open end of the hose. After allowing about a minute for the crankcase pressure to reduce, the paper should be sucked against the opening with a noticeable amount of force.

(2) Turn the engine off. Remove the metered orifice fitting, and check for a plugged condition. A clicking noise should be heard to indicate that the valve mechanism is free.

(3) If the crankcase ventilation system meets the tests in (1) and (2) above, no further service is required. If not, the CCV fitting must be cleaned and the system checked again.

(4) If test (1c) fails when the CCV fitting is cleaned, it will be necessary to replace the molded vacuum hose and clean the metered orifice port.

(5) Clean or replace the engine air cleaner. See "Engine Air Cleaner" in this Group.

FUEL RECOMMENDATIONS

Inspect the fuel system cap, lines, hoses, and connections at the mileage or time intervals specified in the "Maintenance Schedule" in this Group.

Use gasoline having a minimum octane rating of 87 (R + M)/2.

Gasoline Containing Alcohol

Some gasolines sold at service stations contain alcohol, although they may not be so identified. Use of fuels containing alcohol is not recommended, unless the nature of the blend can be determined as being satisfactory.

GASOHOL—A mixture of 10% ethanol (grain alcohol) and 90% unleaded gasoline may be used in your vehicle. If driveability problems are experienced as a result of using GASOHOL, it is recommended that the vehicle be operated on unleaded gasoline, only.

METHANOL—Do not use gasoline containing methanol (wood alcohol). Use of this type of alcohol can result in vehicle performance deterioration and damage to critical parts in the fuel pump, injector, and other fuel system components. Fuel system damage and vehicle performance problems, resulting from the use of gasoline containing methanol alcohol, may not be covered by the new vehicle warranty.

Gasolines Containing MTBE

Gasoline and MTBE blends are a mixture of unleaded gasoline and up to 15% MTBE (Methyl Tertiary Butyl Ether). Gasoline blended with MTBE may be used in your vehicle.

Materials Added to Fuel

Indiscriminate use of fuel system cleaning agents should be avoided. Many of these materials intended for gum and varnish removal may contain highly active solvents or similar ingredients that can be harmful to gasket and diaphragm materials used in fuel system component parts.

Fuel Filter

Replace the fuel filter at 48000 km (30,000 mile) or 30 month intervals.

A plugged fuel filter can be caused by contaminants in the fuel. This can limit the speed at which a vehicle can be driven and cause hard starting. If these conditions occur, the filter should be replaced.

VACUUM OPERATED COMPONENTS

It is recommended to inspect all vacuum operated, emission related, components at the mileage or time intervals specified in the "Maintenance Schedule" in this Group to ensure components are not cracked or broken. Replace component(s), as necessary. Refer to Group 25, "Emission Control System", for additional information.

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

Check the EGR valve and hoses at the mileage or time intervals specified in the "Maintenance Schedule" in this Group. See Group 25, "Emission Control System", for additional information.

IGNITION CABLES, DISTRIBUTION CAP AND ROTOR

The ignition cables should be kept clean and properly connected. Terminals should be fully seated and the nipple assemblies should not be removed from the distributor or coil towers.

Inspect the distributor cap, rotor and ignition wires at the time intervals specified in the "Maintenance Schedule" in this Group.

SPARK PLUGS

Replace the spark plugs at 48000 km (30,000 mile) or 30 month intervals. Refer to Group 8D, "Ignition Systems—Service Procedures", and the "Owners Manual" for additional information.

IGNITION TIMING

Check and adjust the ignition timing according to the specifications shown on the "Engine Emission Control Information Label", located on the hood. Refer to Group 25, "Emission Control System", for additional information.

BATTERY

All vehicles are equipped with maintenance free batteries. Maintenance free batteries are totally maintenance free and have no removable battery cell caps. Water cannot be added to the maintenance free battery. The battery is completely sealed, except for small vent holes in the cover. These vent holes allow what small amount of gases that are produced in the battery to escape. Special chemical composition inside of the battery reduces production of gas to an extremely small amount at normal charging voltages. The battery contains a visual test indicator which signals when an adequate charge level exists

(green indicator), when charging is required (black or dark indicator), or when replacement is required (yellow indicator).

WARNING: ON RARE OCCASIONS, TEST INDICATOR MAY TURN LIGHT YELLOW OR BRIGHT IN COLOR. THIS INDICATES LOW ELECTROLYTE LEVEL. IN THIS CASE, THE VEHICLE CHARGING SYSTEM SHOULD BE THOROUGHLY CHECKED FOR BATTERY OVERCHARGED CONDITION, AS COVERED IN APPLICABLE SECTION OF THE SERVICE MANUAL. ALTHOUGH BATTERY MAY APPEAR SERVICEABLE, REPLACE THE BATTERY. DO NOT ATTEMPT TO CHARGE, TEST, OR JUMP START THE VEHICLE.

RUBBER AND PLASTIC COMPONENT INSPECTION

Variables such as type of vehicle service, geographic area of vehicle operation, and length of exposure time to heat and contaminants are factors affecting the life of rubber and plastic components. To provide best vehicle performance and avoid adverse effect on component life, it is recommended that the following components be inspected when performing other underhood services. **Components should be replaced immediately if there is any evidence of degradation that could result in failure.**

Hoses (Except Emission Hoses)

Refer to Group 25, "Emission Control System", for inspection of emission hoses.

Inspect surface of hoses and nylon tubing for evidence of heat and mechanical damage. Hard and brittle rubber, cracking, checking, tears, cuts, abrasion, and excessive swelling indicate deterioration of the rubber. Hose and nylon tubing located close to the exhaust manifold or any source of intense heat should receive special attention. Be certain that nylon tubing in these areas is not melted or collapsed.

Inspect hose routing to ensure hose does not come in contact with any heat source or moving component which will cause heat damage or mechanical wear.

Inspect all hose connections such as clamps and couplings to make sure they are secure and no leaks are present. **In many instances, fluids such as oil, power steering fluid, and brake fluid are used during assembly of hoses to couplings. Therefore, oil wetness at the hose-coupling area is not necessarily an indication of leakage.** Actual dripping of hot fluid when systems are under pressure (during vehicle operation), should be noted and clamps tightened before hose is replaced based on leakage.

Drive Belts

Check the driving fan, air pump, alternator, power steering pump and air conditioning compressor drive belts for cracks, fraying, wear and general condition at the mileage or time intervals specified in the "Maintenance Schedule" in this Group. Refer to Group 7, "Cooling System", for replacement and/or adjustment specifications and procedures.

Engine Mounts

Inspect the connecting fasteners between the block and the engine mount bracket and those holding the mount to the frame for correct torque as specified in Group 9, "Engine". The rubber in the mount should be inspected for excessive softening and/or swelling caused by oil and/or gasoline contamination. Slight surface deterioration and wear at the ends will not adversely affect performance. If, however, excessive engine movement, rubber softening or swelling, or noise caused by metal-to-metal contact is observed, the engine mount assembly should be replaced.

CAUTION: Avoid continuous contamination with oil or gasoline. Such contamination will result in reduced engine mount life.

EXHAUST SYSTEM

The exhaust system must be properly aligned to prevent stress, leakage, and body contact. If the system contacts any panel, it may amplify objectionable noises originating from the engine or the body.

Inspect the exhaust system at the mileage or time intervals specified in the "Maintenance Schedule" in this Group for the following conditions. Correct as required.

(1) Exhaust system leaks, damage, misalignment.

(2) Grounding against body sheet metal or frame.

(3) Catalytic converter "bulging" or heat damage.

When inspecting an exhaust system, critically inspect for cracked or loose joints, stripped screws/bolt threads, corrosion damage, and worn or broken hangers. Replace all components that are badly corroded or damaged. Do not attempt repair.

CAUTION: The catalytic converter(s) will become contaminated if leaded gas is used, or if the engine or emission controls are not maintained as scheduled. If this occurs, the catalyst (the alumina-coated beads in the converter) or the entire converter must be replaced.

AIR CONDITIONING

The air-conditioning system should be inspected and tested whenever a reduction in cooling performance is experienced or at the start of each warm season. Service should include cleaning the condenser fins, check drive belt tension, and test overall A/C performance. See Group 24, Heating and Air-Conditioning for more information.

DRIVETRAIN

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AUTOMATIC TRANSAXLE

The Premier vehicles have the automatic transmission and differential assembly contained within a single housing (front-wheel drive). The transaxle assembly is filled through the dipstick fill tube in the case (Figs. 13 and 14).

Selection of Lubricant

If it becomes necessary to add fluid to the transmission, use Mercon™, or equivalent automatic transmission fluid.

Special Additives

Chrysler Motors does not recommend the addition of any fluids to the transmission, other than the automatic transmission fluid listed above. An exception to this policy is the use of special dyes to aid in detecting fluid leaks. The use of transmission sealers should be avoided, since they may adversely affect seals.

Fluid Level Check

WARNING: TO GUARD AGAINST INJURY, STAY CLEAR OF THE FAN AND DRIVE BELTS WHEN THE ENGINE IS RUNNING.

Check the fluid level at the mileage or time intervals specified in the "Maintenance Schedule" in this Group. Perform the following steps to check the fluid level:

(1) Bring the transmission up to the normal operating temperature.
(2) Place the vehicle on a level surface.
(3) Have the engine running at idle speed.
(4) Apply the parking brake.
(5) Remove the dipstick, and wipe it clean.
(6) Insert the dipstick until the cap seats.
(7) Remove the dipstick and note the reading on the HOT side (Figs. 13 and 14). The fluid level should be within the crosshatch area between the ADD and FULL marks.
(8) If it is at or below the ADD mark, add suffi-

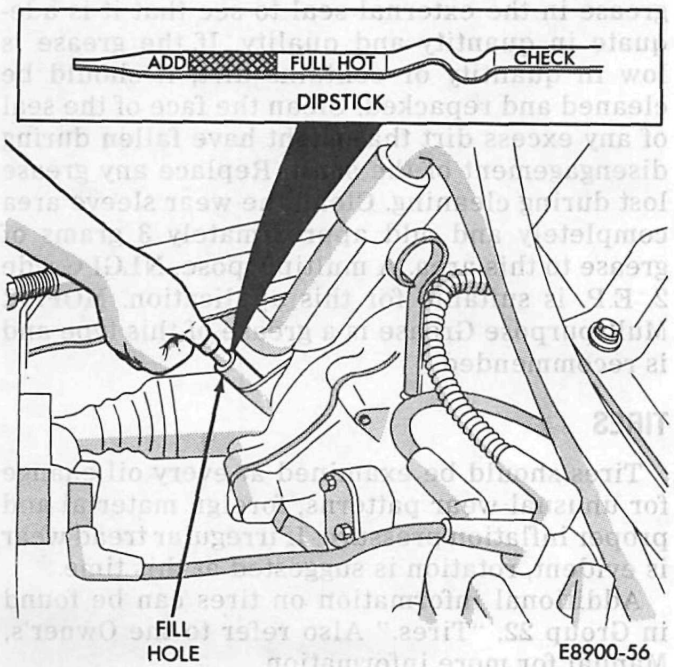


Fig. 13—Transaxle Dipstick and Fill Hole (2.5L)

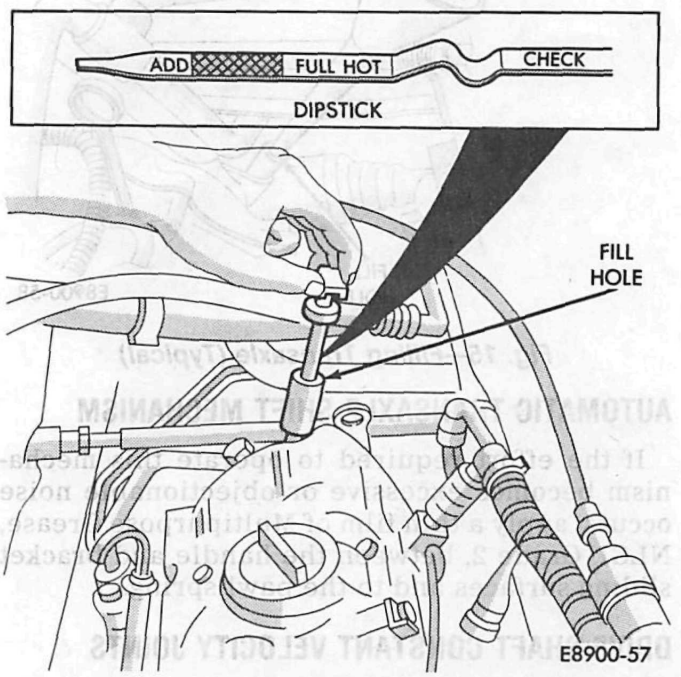


Fig. 14—Transaxle Dipstick and Fill Hole (3.0L)

cient fluid to raise the level to the FULL mark. Use Mercon™ automatic transmission fluid or equivalent. With a long-necked funnel inserted into the dipstick tube, add just enough fluid to fill the transmission to the proper level (Fig. 15). It takes only 0.5L (1.0 Pint) of fluid to raise the level from ADD to FULL.

CAUTION: Do not overfill. Overfilling can cause foaming which can lead to overheating, fluid oxidation or varnish formation.

(9) When checking the fluid level, also check the fluid condition. If the fluid smells burned or is full of metal or friction material particles, a complete transmission overhaul may be needed. Examine the fluid closely. If doubtful about its condition, drain out a sample for a double check.

(10) Install the dipstick into the filler tube.

(11) Check for leaks.

Fluid and Filter Changes

Change the automatic transmission fluid and filter at 48000 km (30,000 mile) or 30 month intervals. If the transmission is disassembled for any reason, the fluid and filter should be changed and the bands adjusted (see Group 21, "Transaxle", for service procedures).

Refer to Group 21, "Transaxle" for the complete draining and filling procedure.

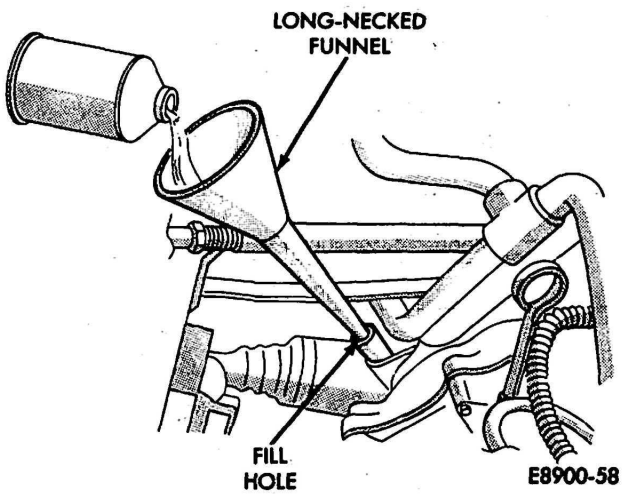


Fig. 15—Filling Transaxle (Typical)

AUTOMATIC TRANSAXLE SHIFT MECHANISM

If the effort required to operate this mechanism becomes excessive or objectionable noise occurs, apply a thin film of Multipurpose Grease, NLGI, Grade 2, between the handle and bracket sliding surfaces and to the pawl spring.

DRIVE SHAFT CONSTANT VELOCITY JOINTS

The vehicle is equipped with four constant velocity joints and boots (Fig. 16). Periodic lubrication of these joints is not required. However, the joint boots should be inspected for external leakage or damage periodically. If external leakage or damage is evident, the boot and grease should be replaced immediately. Continued operation could result in failure of the constant velocity joint due to water and dirt contamination of the grease. This would require complete replacement of the joint assembly. Refer to Group 2 "Suspension" for replacement procedure.

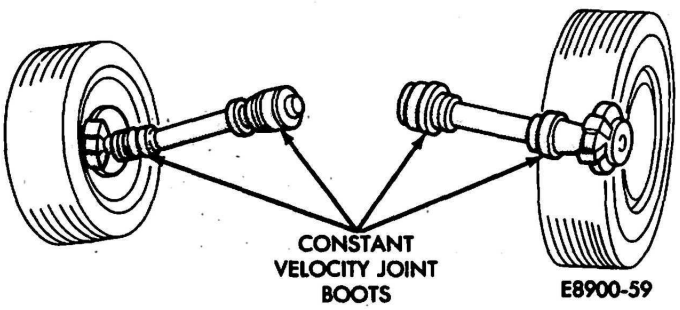


Fig. 16—Constant Velocity Joint Boots

FRONT WHEEL BEARING

The vehicle is equipped with permanently sealed front wheel bearings. There is no periodic lubrication maintenance recommended for these units. However, the following checks and precautions should be made whenever the drive shaft is disassembled from the knuckle. Dirt must be prevented from falling into the greased areas between the bearing and the external seal and on the wear sleeve of the outer joint. Check the grease in the external seal to see that it is adequate in quantity and quality. If the grease is low in quantity or contains dirt, it should be cleaned and repacked. Clean the face of the seal of any excess dirt that might have fallen during disengagement of the shaft. Replace any grease lost during cleaning. Clean the wear sleeve area completely and add approximately 3 grams of grease to this area. A multipurpose, NLGI Grade 2, E.P. is suitable for this application. MOPAR Multipurpose Grease is a grease of this type and is recommended.

TIRES

Tires should be examined at every oil change for unusual wear patterns, foreign material and proper inflation pressure. If irregular tread wear is evident, rotation is suggested at this time.

Additional information on tires can be found in Group 22, "Tires." Also refer to the Owner's, Manual for more information.

CHASSIS AND BODY

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STEERING LINKAGE

Whenever the vehicle is hoisted, all steering linkage joints should be thoroughly inspected for evidence of damage. Damaged seals should be replaced to prevent leakage or contamination of the grease. When lubricating joints use only the special long life chassis grease such as MOPAR Multimileage Lubricant, or equivalent.

Refer to the "Maintenance Schedule" in this section for the proper lubricating interval.

FRONT SUSPENSION BALL JOINTS

Inspection

The front suspension ball joints should be inspected whenever a vehicle is serviced for other reasons. Damaged seals should be replaced to prevent leakage or contamination of the grease.

Lubrication Ball Joints

Ball joints are semipermanently lubricated at the factory with a special grease. When lubricating ball joints, use only a special long life MOPAR Multimileage Lubricant, or equivalent.

Refer to the "Maintenance Schedule" in this section for the proper lubricating interval.

Procedure

Before lubrication, clean the accumulated dirt and grease from the outside surface of the seal. Wipe off the outside surface of the grease fittings to remove dirt from the grease inlet area. This will avoid new grease contamination.

Then fill and flush the joints with lubricant. Stop filling when grease begins to flow freely from the bleed areas at the base of the seal, or if the seal begins to balloon.

After lubrication, wipe off any excess grease from the exterior surfaces of ball joints and adjacent component surfaces.

POWER STEERING

Checking Fluid Level

Check the fluid at the mileage or time intervals specified in the "Maintenance Schedule" in this Group. The pump fluid reservoir is separate from the pump. The reservoir is on the driver's side inner fender panel (2.5L—Fig. 1) and near the front of the left cylinder head (3.0L—Fig. 2). If the fluid level is below the FULL mark on the dipstick, add MOPAR power steering fluid, or equivalent. The dipstick is attached to the reservoir cap.

Inspection

Check the power steering gear assembly for leaks, housing cracks or loose frame mounting. Inspect the steering damper for leaks or loose mounting.

BRAKES

Master Cylinder

Check the fluid level at the mileage or time intervals specified in the "Maintenance Schedule" in this Group.

Clean the top of the cover and surrounding housing area. Unscrew the cap. The fluid should be filled to the bottom of the filler neck. If not,

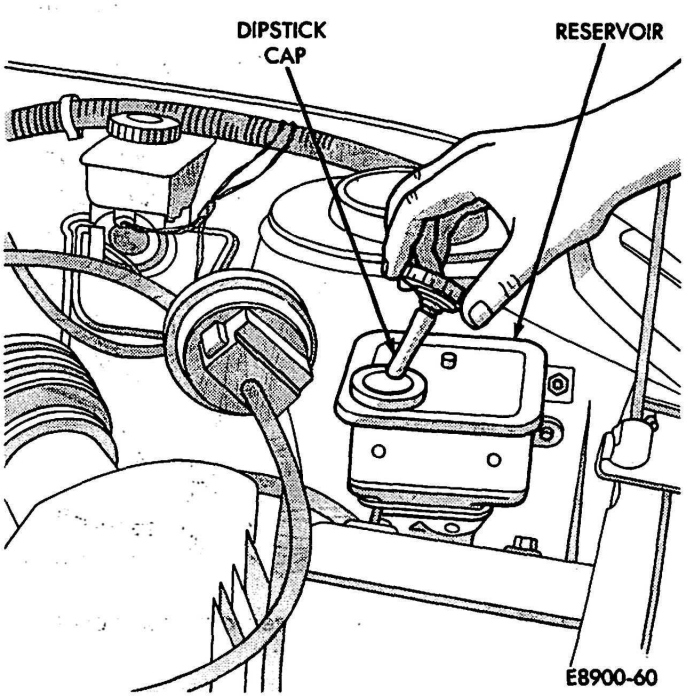


Fig. 1—Reservoir and Dipstick Cap (2.5L)

add brake fluid as required. Use only MOPAR Heavy-Duty brake fluid, or equivalent, identified as FMVSS 116 DOT-3 and SAE J-1703F.

Check the cap and housing for signs of leakage (Fig. 3). If internal leaks are suspected or if fluid loss occurs but a leak is not evident, check for leaks at the rear of the master cylinder. Correct as required. Install the brake reservoir cap.

Brake and Chassis Inspection

Check the brake and chassis at the mileage or time intervals specified in the "Maintenance Schedule" in this Group.

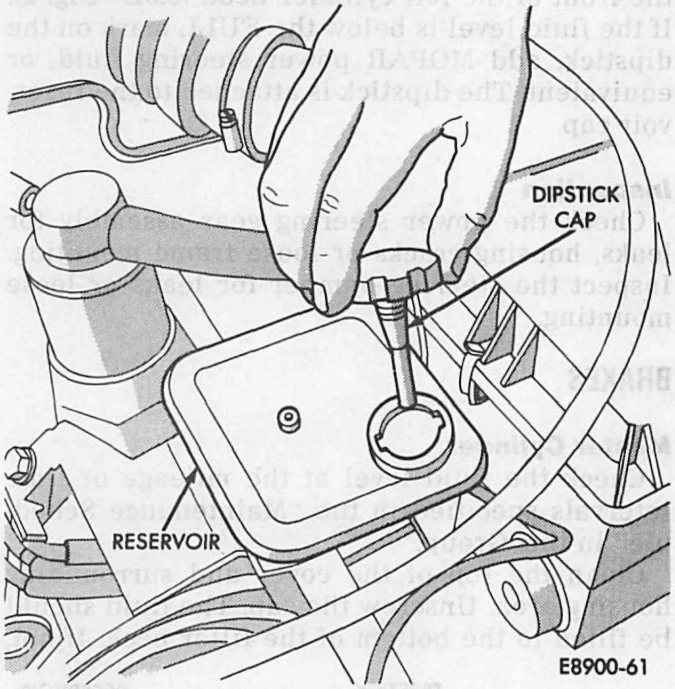


Fig. 2—Reservoir and Dipstick Cap (3.0L)

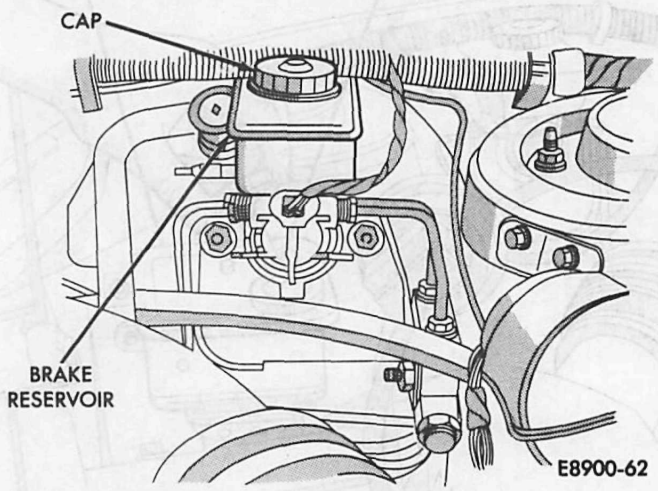


Fig. 3—Checking Brake Reservoir Fluid Level

Inspect the linings for wear, cracks, charred surfaces or broken rivets.

Check for contamination by brake fluid, axle lubricant or other contaminants.

Replace the front and rear brake linings if worn.

Operate the rear self-adjuster lever and pivot. Check for ease of operation of the adjuster screw assembly. Check the condition of the adjuster components for bending, frayed cables, loose or overheated springs or binding.

Check the disc brake caliper dust boot for correct installation, tears or signs of leakage. Check bushings and pins for binding, corrosion or tears.

Pull the rear wheel cylinder dust boot back and inspect for leaks. Check the condition of the pistons and cylinder bores.

Check the differential warning valve and housing for signs of leaks, kinked lines or loose fittings.

Brake Hoses

Check for cracks, swelling, kinks, distortion or leaks. Also inspect the position to be sure no lines are rubbing against the exhaust system parts or other components.

Parking Brake

Operate the parking brake pedal and release it. Then check it for smooth operation and brake-holding ability. Inspect the cables for binds, kinks or frays. With the brake released, the rear wheels should turn freely. Adjust the parking brake, if necessary.

Overall Brake Condition and Action

Check for improper brake action, performance complaints or signs of overheating, dragging or pulling. Correct as required (see Group 5, "Brakes").

BODY LUBRICATION

Lubricate the body components with the lubricant specified at the mileage or time intervals specified in the "Maintenance Schedule" in this Group. When lubricating the weatherstrips and seals, apply the lubricant to a rag and wipe it on the seal to avoid dust-collecting over-spray which can soil passenger clothing.

Prior to the application of any lubricant, the parts concerned should be wiped clean to remove dust and grit. After lubrication, excess oil or grease should be removed.

Particular attention should be given to external lock cylinders during fall and winter months to ensure protection from water and ice.

Particular attention should also be given to hood latching components to ensure proper function. When performing other underhood services, the hood latch, release mechanism and safety catch should be cleaned and lubricated.

BODY MECHANISMS

The following mechanisms should be inspected, cleaned and all pivot and sliding contact areas of these components lubricated at the mileage or time intervals specified in the "Maintenance Schedule" in this Group. Refer to Fig. 4 for the proper lubricant.

COMPONENT	SPECIFICATIONS
ASHTRAY SLIDES, FRONT SEAT TRACKS, HINGES, DOOR, HOOD, TRUNK LID, LATCHES, GLOVE BOX	WHITE SPRAY GREASE
KEY LOCK CYLINDERS	LOCK LUBRICANT
WEATHERSTRIPS, DOORS, WINDOWS, TRUNK	SILICONE LUBRICANT SPRAY
WINDSHIELD WIPER BLADES	REPLACE
KEYLESS ENTRY TRANSMITTER	REPLACE BATTERIES CR2016 3-VOLT

E8900-63

Fig. 4—Body Mechanism Maintenance

HEADLIGHTS

To assure correct adjustment of headlight aiming, it is recommended that the headlights be checked and, if necessary, reaimed properly every six months.

Changes in front and rear suspension, such as suspension height and/or deflection of rear springs due to heavy load, will change the headlight beam pattern and may cause unsafe night time driving conditions.

If a vehicle is to be loaded abnormally, such as for a vacation trip, or with a salesman's products, the headlight aiming should be checked and adjusted to serve the new conditions. Refer to Group 8L, "Exterior Lighting", for adjusting procedures.

SUSPENSION

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GENERAL INFORMATION

DESCRIPTION

Front Suspension

The front suspension (Fig. 1) for Eagle Premier vehicles is comprised of:
- two coil springs and struts (shock absorbers);
- a stabilizer bar;
- two suspension arms with ball-joint/stud ends;
- two wheel hubs and bearings; and
- two suspension knuckles.

Rear Suspension

The rear suspension (Fig. 1, Fig. 2) for Eagle Premier vehicles is comprised of:
- two gas charged (high-pressure) shock absorbers;
- a V-shaped crossmember with two trailing suspension arms;
- two torsion support brackets with rubber bushings that connect between the vehicle chassis and the trailing suspension arms;
- four interconnecting torsion bars that function as rear springs and rear stabilizer bar; and
- two stub axle shafts with wheel hub locknuts.

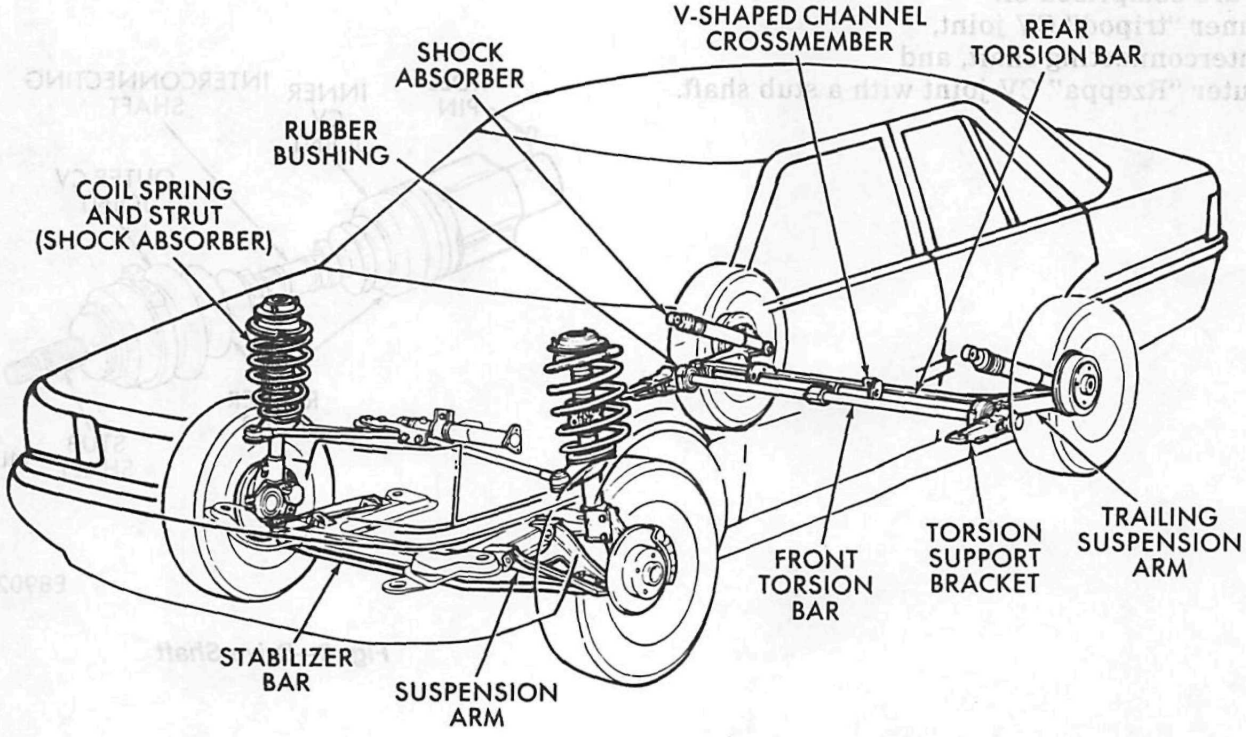


Fig. 1—Front & Rear Suspension Components

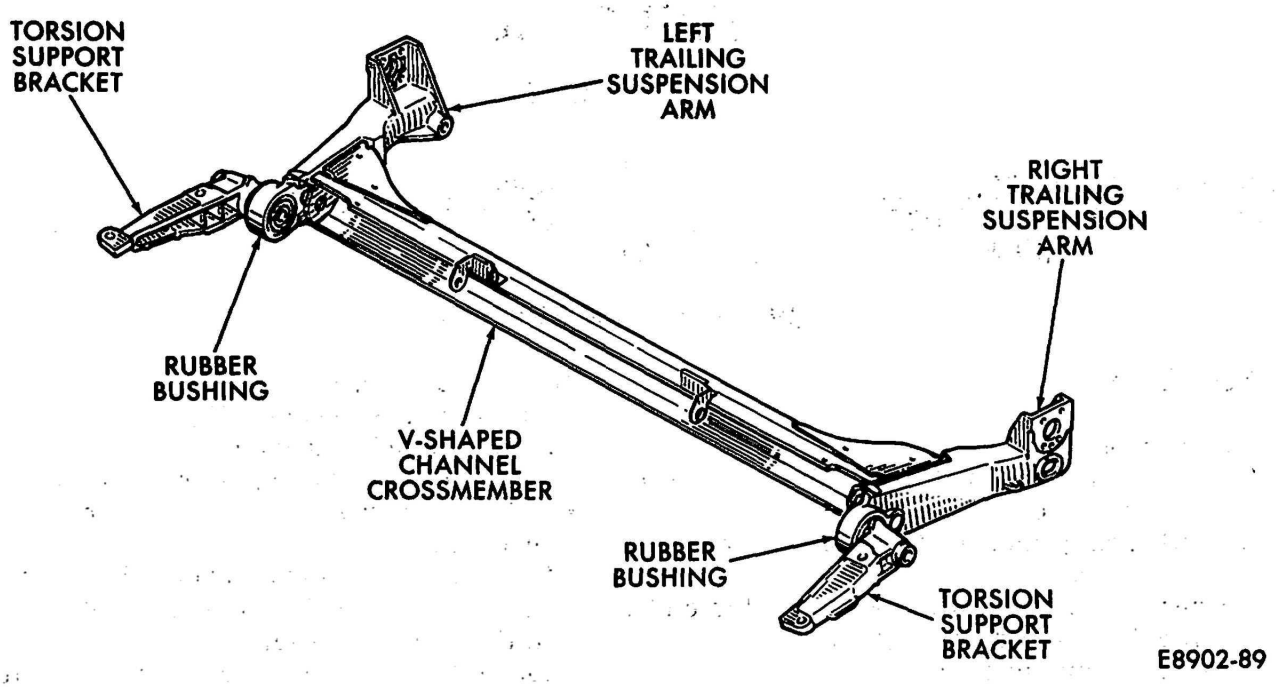


Fig. 2—Rear Suspension Components

Drive Shafts

The drive shafts (Fig. 3) for Eagle Premier vehicles are comprised of:

- an inner "tripod" CV joint,
- an interconnecting shaft, and
- an outer "Rzeppa" CV joint with a stub shaft.

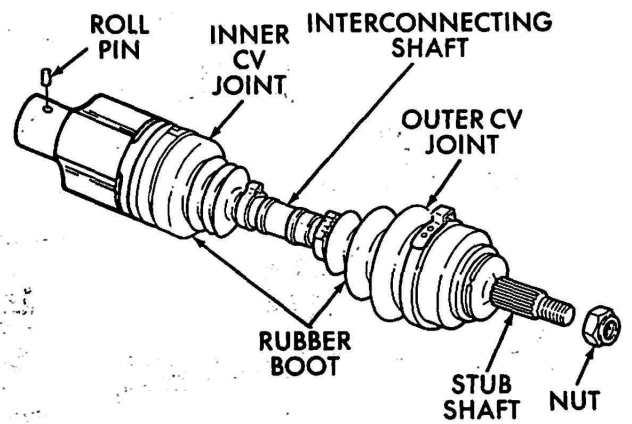


Fig. 3—Drive Shaft

FRONT SUSPENSION SERVICE

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FRONT SPRING AND STRUT

Removal

CAUTION: DO NOT support the vehicle by placing supports under the suspension arms.

(1) Raise and support the front of the vehicle.

(2) Remove the wheel/tire.

(3) Remove the outer tie-rod end ball stud-to-bracket nut and remove the outer tie-rod end from the strut body bracket with an appropriate puller tool (Fig. 4).

WARNING: DO NOT remove the strut stud-to-tower cushion locknut (Fig. 5). The coil spring is compressed and has very strong spring tension.

(4) Remove the 3 strut tower cushion-to-tower attaching bolts (Fig. 5).

CAUTION: Before proceeding to the next step, ensure that the front suspension is "hanging free". There must not be any pressure or tension on any of the front suspension components.

The strut body-to-suspension knuckle bolts are "splined". Remove the bolts only as instructed in the procedure below.

(5) Remove the two "splined" bolts that attach the strut body to the suspension knuckle (Fig. 6) according to the following instructions:

- loosen the nuts,
- turn the nuts until they are almost at the end of the bolt threads,
- "tap" the nuts with a brass hammer to loosen the bolts and disengage the splines, and
- remove the nuts and slide the bolts out of the strut body and the suspension knuckle.

(6) For protection, wrap the drive shaft boot (Fig. 6) with a heavy duty shop cloth or towel to prevent damage to the boot.

(7) Press down on the suspension arm and remove the guide the strut and spring past the drive shaft. Use care to prevent the strut body from contacting the drive shaft boot during removal.

Disassembly

(1) Place the lower plate (Fig. 8) of Spring Compressor Tool Set 7464 (Sus. 1052.99) in a vise.

Tool set 7464 (Sus. 1052.99) contains several different upper adapter plates for various vehicles (Fig. 9).

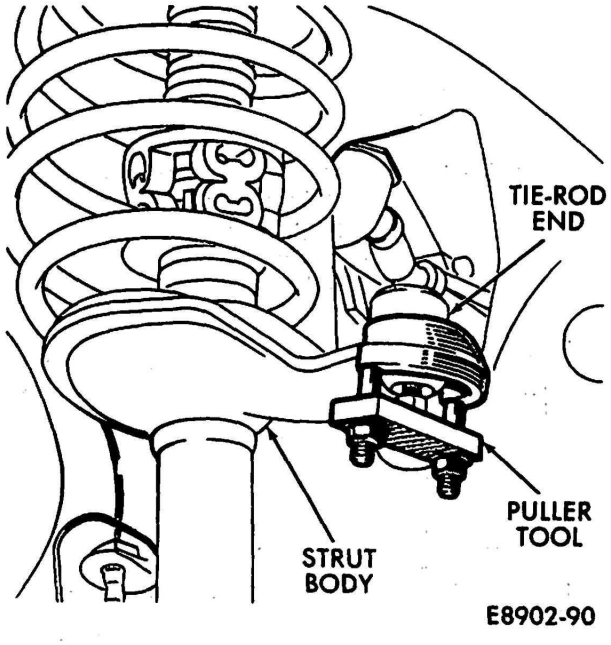


Fig. 4—Tie-Rod End Removal

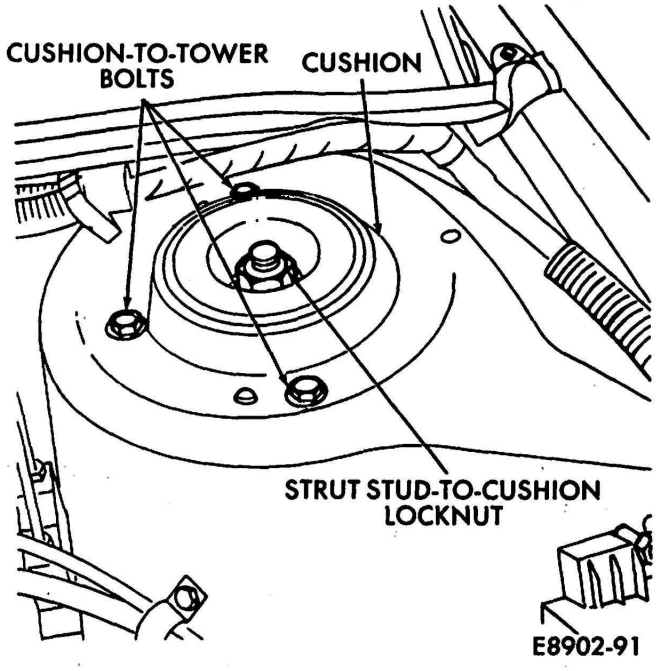


Fig. 5—Strut Tower Cushion Removal

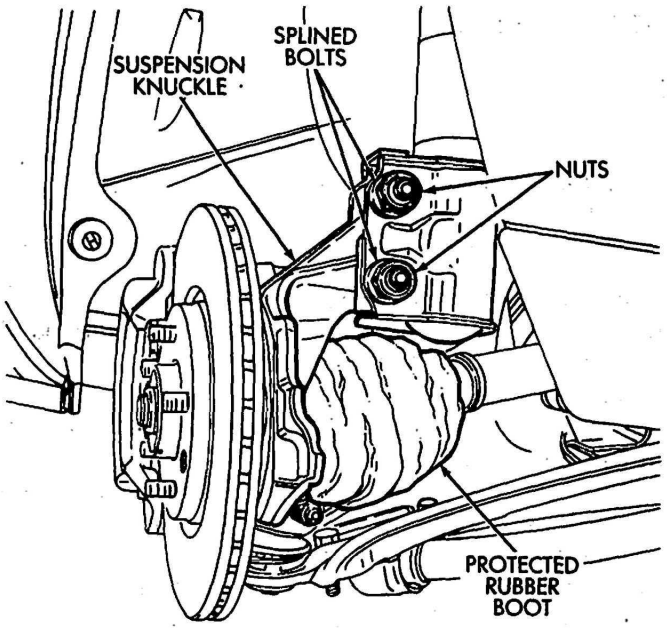


Fig. 6—Strut Body Removal

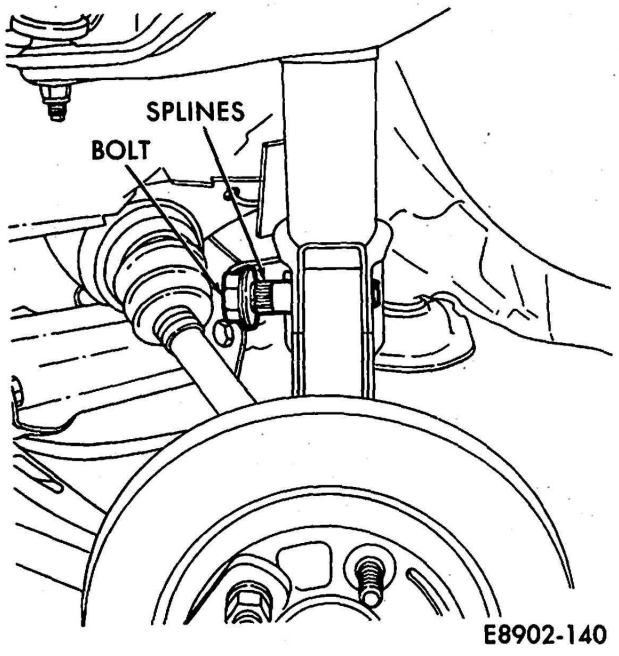


Fig. 7—Strut Body-To-Suspension Knuckle Bolt Removal

Use the adapter plate stamped R-21 and shaped as illustrated (Fig. 10) for Premier vehicles.

(2) Place the lower adapter plate (shoulder down) on the lower plate (Fig. 11).

(3) Position the upper adapter plate (R-21) around the lower part of the spring/strut and place it on top of the lower adapter plate (Fig. 11).

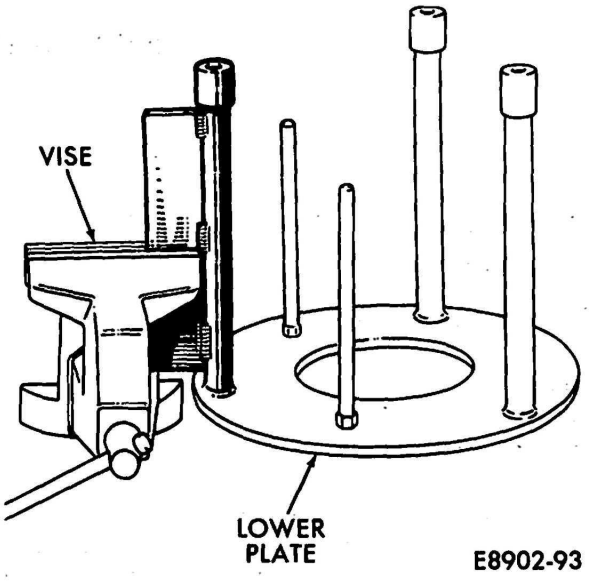


Fig. 8—Lower Plate of Spring Compressor Tool

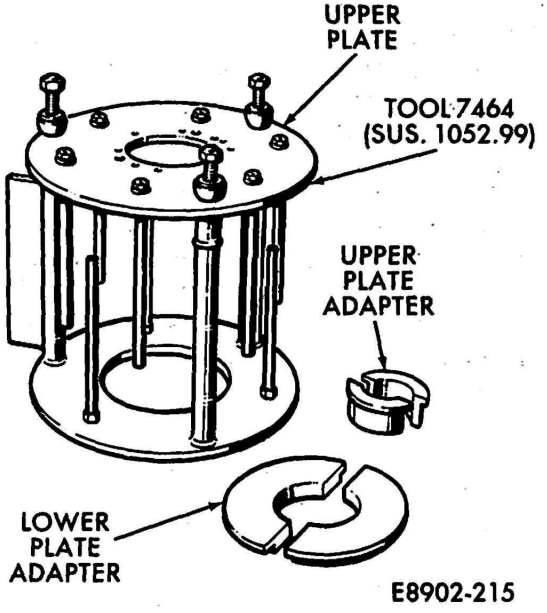


Fig. 9—Spring Compressor Tool Set 7464 (Sus. 1052.99)

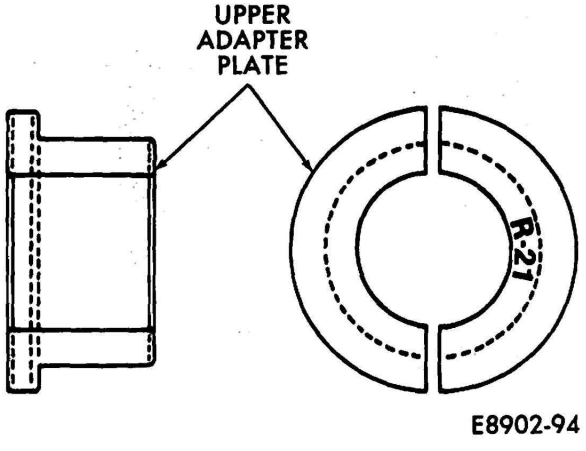


Fig. 10—Premier Adapter Plate R-21

Ensure that the spring/strut is properly seated on the tool before proceeding.

If not previously modified, the upper plate (Fig. 12) from tool set 7464 (Sus. 1052.99) must be modified for Premier vehicles.

(4) If not previously modified for Premier vehicles, enlarge the diameter of the three existing holes (as indicated in Fig. 12) in the upper plate to 11.5 mm (7/16 inch). This will allow the three 8 mm (5/16 in) strut tower cushion attaching bolts to be inserted through the upper plate holes (Fig. 13).

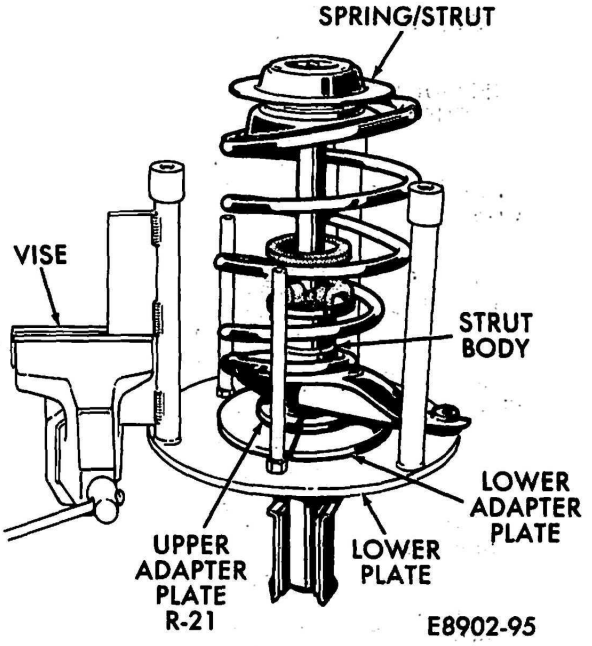


Fig. 11—Lower & Upper Adapter Plates

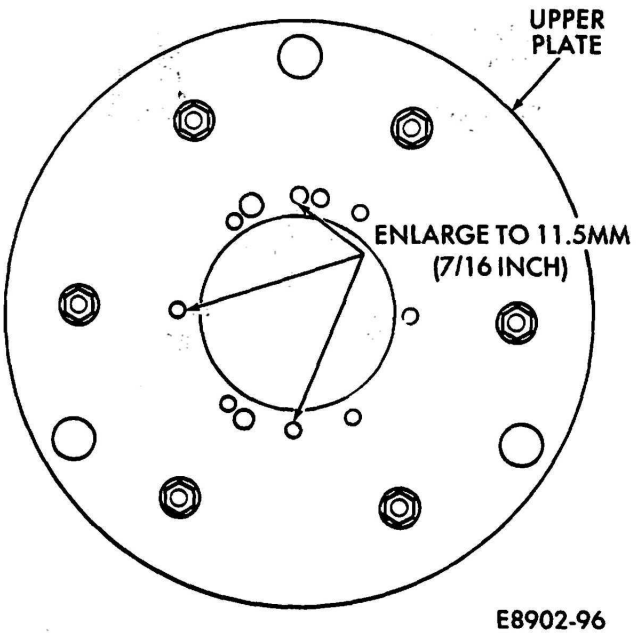


Fig. 12—Upper Plate Modification

(5) Install the modified upper plate (Fig. 13) on the top of the spring/strut.

(6) Rotate the spring/strut until the strut tower cushion bolt holes align with the drilled holes in the upper plate (Fig. 13).

(7) Insert three 8-mm (5/16-in) bolts through the upper plate and tighten them in the strut tower cushion (Fig. 13).

The upper plate-to-strut tower cushion bolts (Fig. 13) must be 8-mm (5/16-in) bolts and be at least 40 mm (1-1/2 in) in length.

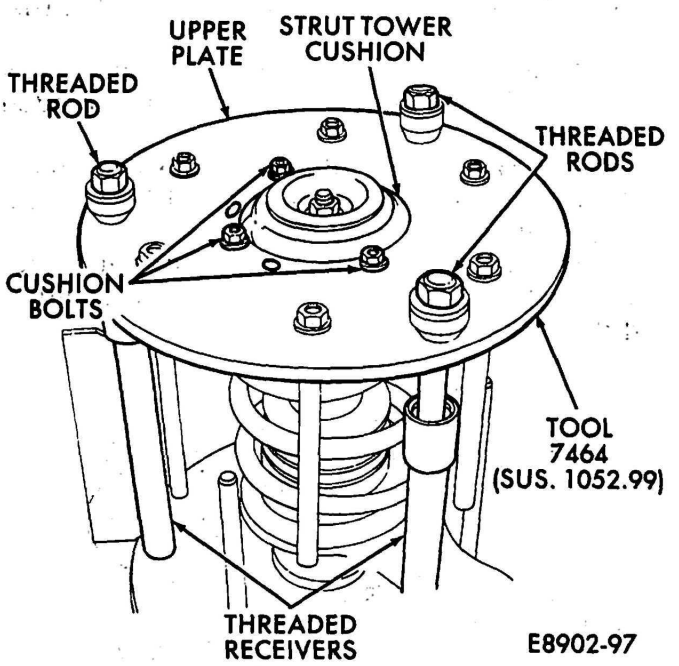


Fig. 13—Spring Compressor Tool Installed

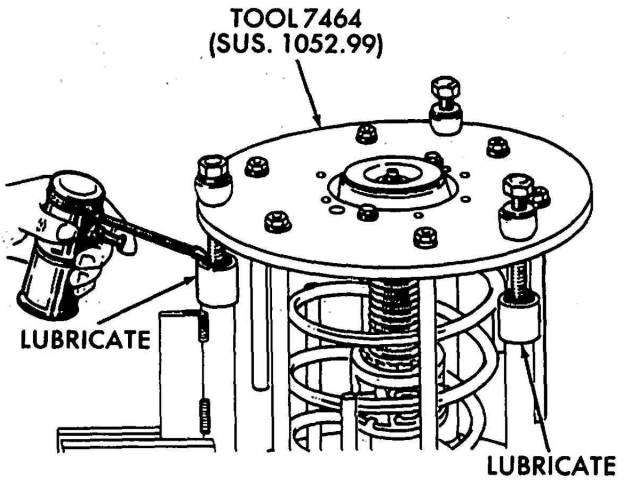


Fig. 14—Threaded Rod/Receiver Lubrication

(8) Install the threaded rods in the threaded receivers (Fig. 13).

(9) Because the Spring Compressor Tool Set 7464 (Sus. 1052.99) will be forced against very high spring tension, apply a liberal amount of lubricant on the threaded rods and receivers (Fig. 14).

(10) Turn the threaded rods and slowly compress the upper plate and coil spring approximately 10 mm (13/32 in.).

(11) Use an appropriate size Allen wrench to hold the strut stud stationary and remove the strut stud-to-tower cushion locknut (Fig. 15). Discard the locknut.

(12) Remove the tension from the spring by alternately and evenly loosening the threaded rods (Fig. 13).

(13) Remove the threaded rods, the strut tower cushion bolts and the upper plate (Fig. 13) from spring/strut.

(14) Remove the rebound cup, the strut tower cushion, the pivot bearing, the spring retainer and the coil spring (Fig. 16).

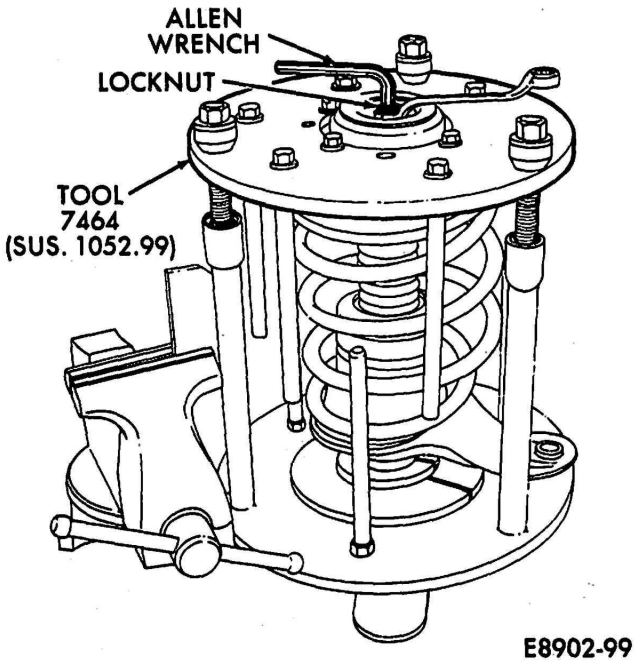


Fig. 15—Strut Tower Cushion Locknut Removal

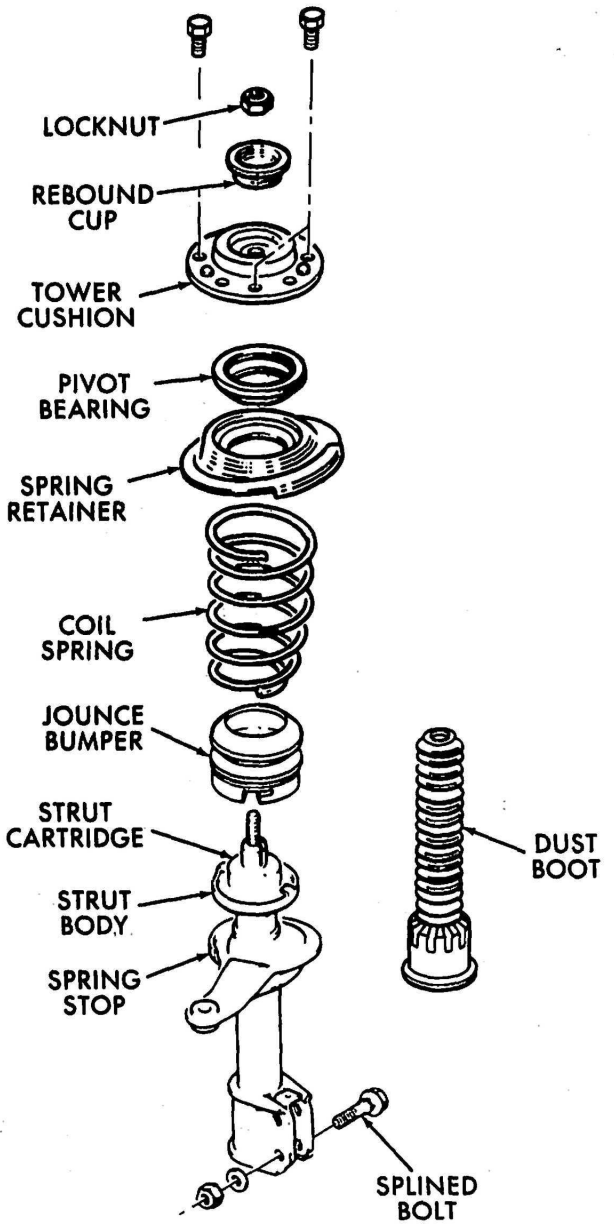


Fig. 16—Spring/Strut (Exploded View)

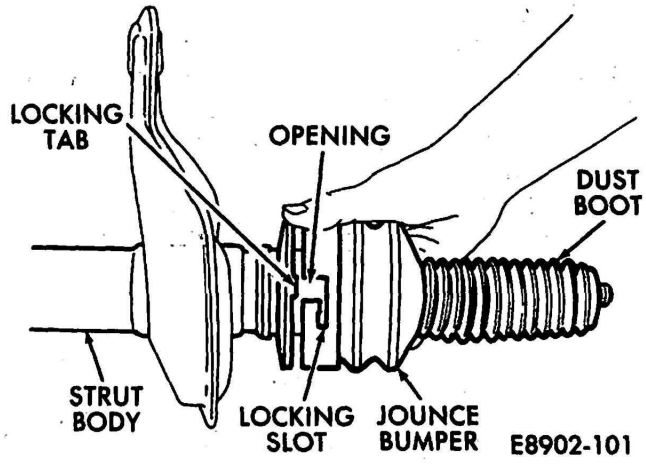


Fig. 17—Jounce Bumper & Dust Boot

Assembly

(1) Install the dust boot (Fig. 16) over the strut body.

(2) Install the jounce bumper (Fig. 16) on the strut body. Twist the jounce bumper until the strut locking tabs are seated in the jounce bumper locking slots (Fig. 17).

(3) Position the coil spring over the jounce bumper and in the strut body recess. Rotate the spring until its end is seated against the "stop" in the strut body recess (Fig. 16).

(4) Place the spring retainer (Fig. 16) on top of the coil spring. Rotate the spring retainer until the "stop" "butts" against the end of the coil spring.

(5) Place the pivot bearing (Fig. 16) on top of the spring retainer.

(6) Place the strut tower cushion (Fig. 16) on top of the pivot bearing.

(7) Position the spring/strut on Spring Compressor Tool Set 7464 (Sus. 1052.99) with the lower adapter plate positioned (shoulder downward) on the lower plate. Position the upper adapter plate (R-21) around the lower part of the spring/strut (Fig. 18).

Ensure that the spring/strut is properly seated on the tool before proceeding.

(8) Install the modified upper plate. (Fig. 19) on the top of the spring/strut.

(9) Rotate the spring/strut until the strut tower cushion bolt holes align with the drilled holes in the upper plate (Fig. 19).

(10) Insert three 8-mm (5/16-in) bolts through the upper plate and tighten them in the strut tower cushion (Fig. 19).

The upper plate-to-strut tower cushion bolts (Fig. 18) must be 8-mm (5/16-in) bolts and be at least 40 mm (1-1/2 in) in length.

(11) Install the threaded rods in the threaded receivers (Fig. 19).

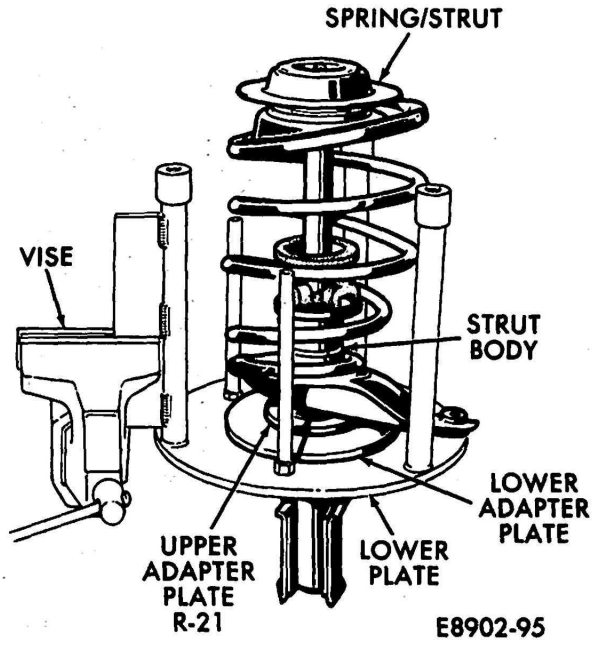


Fig. 18—Spring/Strut on Spring Compressor Tool

(12) Examine the position of the lower and upper ends of the coil spring. They must be butted against the "stops" in the strut body recess and the spring retainer.

(13) Slowly, alternately and evenly compress the upper plate and spring (Fig. 20) with the threaded rods until the vertical height of the spring/strut is approximately 400 mm (15.7 in.). While compressing the spring, carefully guide the strut stud through the hole in the strut tower cushion.

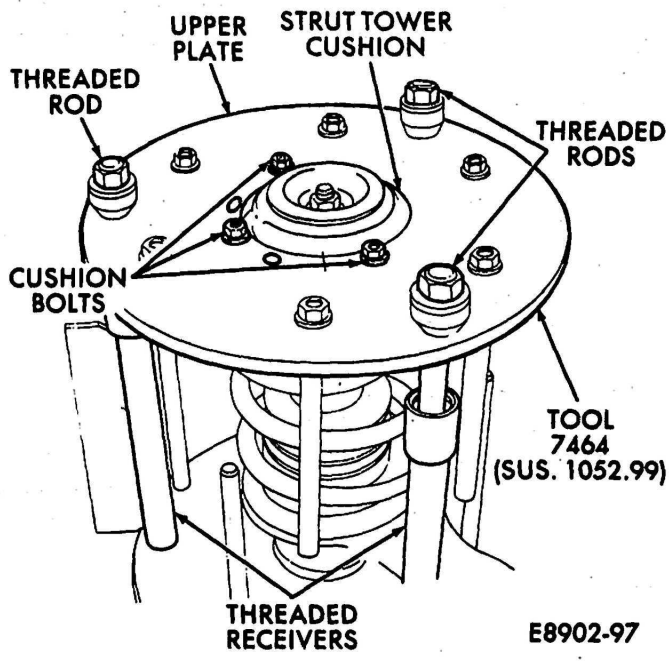


Fig. 19—Spring Compressor Tool Installed

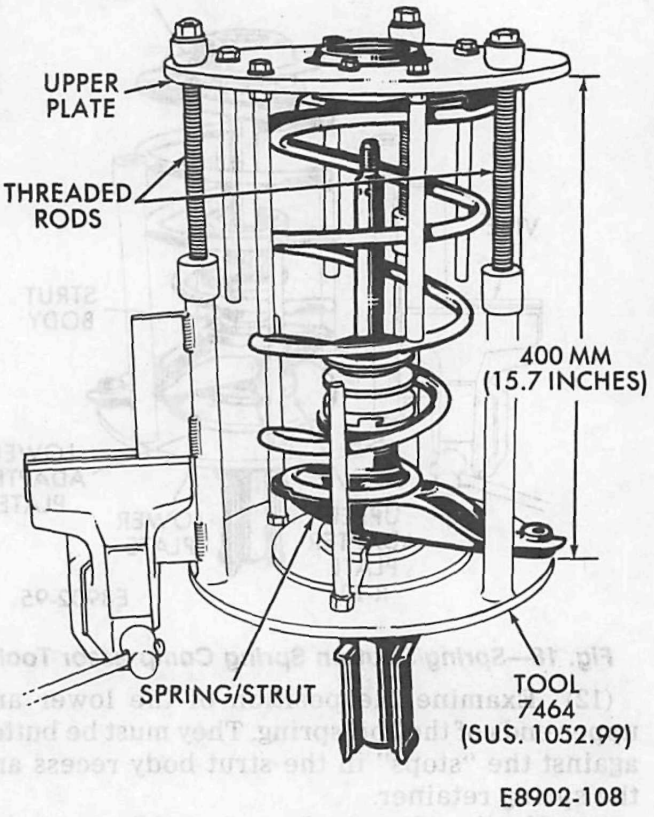


Fig. 20—Compressing The Spring

If difficulty is experienced in guiding the strut stud through the hole in the strut tower cushion, insert the tip of a screwdriver in the hex-shaped hole located at the top of the stud for stud-to-hole alignment.

(14) Continue to tighten threaded rods until the strut stud is inserted through the hole in the strut tower cushion with sufficient threads available to install the locknut.

(15) Place the rebound cup on the strut tower cushion and install a replacement strut stud-to-tower cushion locknut (Fig. 16).

(16) Tighten the locknut (use an appropriate size Allen wrench to hold the stud stationary) with 70 N· (52 ft-lbs) torque.

(17) Slowly release the threaded rods until all the spring tension has been released.

(18) Remove the three strut tower cushion-to-upper plate bolts (Fig. 19).

(19) Remove the upper plate (Fig. 20).

(20) Remove the spring/strut from the spring compressor tool and install it on the vehicle. If necessary, refer to the installation procedure.

Installation

(1) Carefully route the spring/strut assembly over the drive shaft boot and locate it correctly for installation of the attaching bolts. Install and tighten the strut tower cushion-to-tower bolts (Fig. 21) "finger-tight."

Ensure that the bolt splines are properly aligned in the strut body holes before "tapping" the bolts into position and installing the nuts. Retain each bolt head in place with a wrench when tightening the nut.

CAUTION: Tighten with a wrench turning the strut body retaining nuts only. DO NOT attempt to turn the bolts because they are "splined."

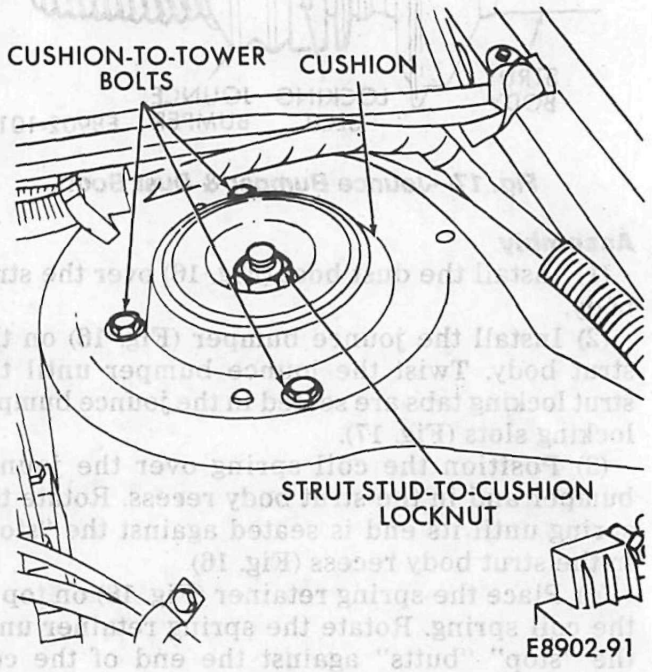


Fig. 21—Spring/Strut Installation

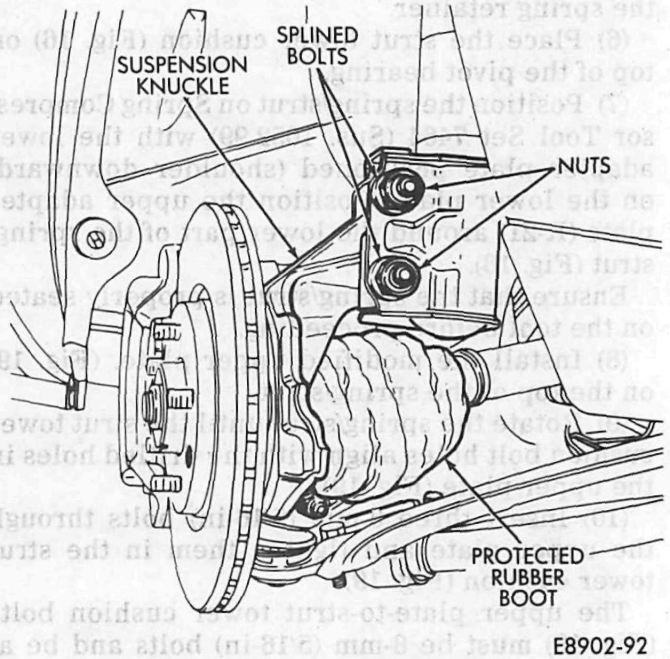


Fig. 22—Strut Body-to-Knuckle Nuts & Bolts

(2) Install the strut body-to-suspension knuckle bolts and nuts. Tighten the nuts (Fig. 28) with 167 N·m (123 ft-lbs) torque.

(3) Tighten the strut tower cushion-to-tower bolts (Fig. 27) with 23 N·m (17 ft-lbs) torque.

(4) Position the outer tie-rod end ball stud in the hole in the strut body bracket. Install and tighten the tie-rod end ball stud-to-bracket nut with 48 N·m (35 ft-lbs) torque.

(5) Remove the shop cloth or towel from around the drive shaft boot and install the wheel/tire. Tighten steel wheel lug nuts with 85 N·m (63 ft-lbs) torque. Tighten aluminum wheel lug nuts with 122 N·m (90 ft.lbs.) torque.

(6) Remove the support and lower the vehicle.

Because the outer tie-rod end was disconnected and then connected to the strut body bracket, it is recommended that front wheel toe be measured and adjusted (if necessary) after spring/strut installation. Refer to FRONT WHEEL ALIGNMENT this group, for detailed instructions.

FRONT STABILIZER BAR

Removal

For ease of stabilizer bar removal and installation, do not raise the vehicle (i.e., support the weight of the vehicle with the wheel/tires).

(1) Remove the bolts (Fig. 23) that retain the stabilizer bar inner brackets to the engine cradle.

(2) Remove the retaining nuts (Fig. 24) from the stabilizer bar outer bracket bolts at the suspension arms.

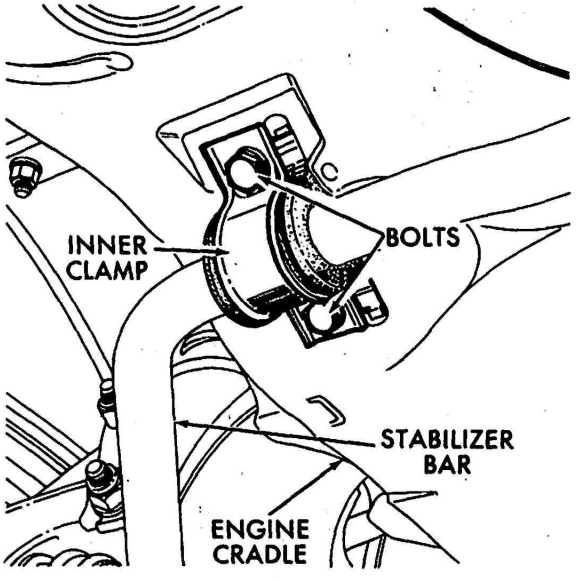


Fig. 23—Stabilizer Bar Inner Bracket Removal

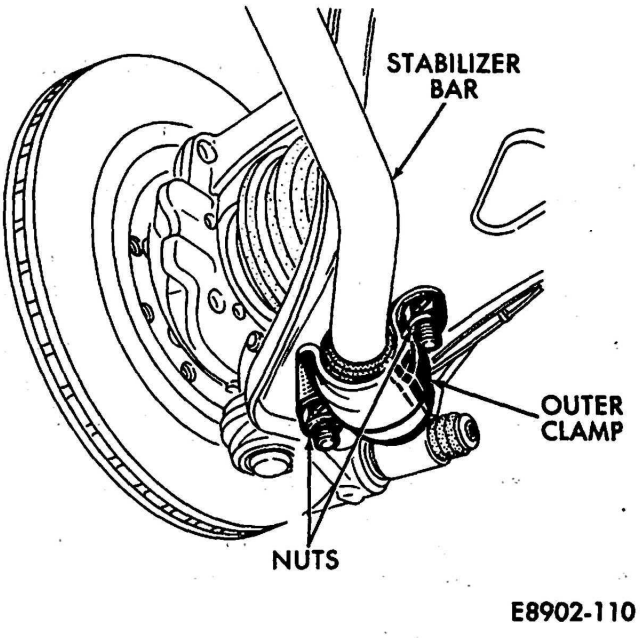


Fig. 24—Stabilizer Bar Outer Bracket Removal

The nuts and the bolts that retain each stabilizer bar outer bracket (Fig. 24) to the suspension arm also retain each ball joint to the suspension arm.

(3) Remove the stabilizer bar and brackets from the vehicle.

(4) Install a nut (Fig. 24) at each side of the vehicle on one of the two ball joint retaining bolts to ensure that the suspension arms and the ball joints do not separate.

(5) Inspect the condition of the stabilizer bar bushings and replace them if necessary.

Installation

(1) If necessary, install replacement bushings on the stabilizer bar.

(2) Remove the nuts that are retaining the suspension arms and the ball joints together.

(3) Position and retain the stabilizer bar in place at the suspension arms and at the engine cradle.

(4) Position the outer brackets on the stabilizer bar at the suspension arms. Install and tighten the bracket retaining nuts (Fig. 24) "finger-tight."

(5) Position the inner brackets on the stabilizer bar at the engine cradle. Install and tighten the bracket retaining bolts (Fig. 23) "finger-tight."

(6) With the vehicle weight supported by the wheels/tires, tighten the inner bracket retaining bolts at the engine cradle (Fig. 23) with 28 N·m (21 ft-lbs) torque and tighten the outer bracket retaining nuts at the suspension arms (Fig. 24) with 82 N·m (60 ft-lbs) torque.

SUSPENSION ARM

Removal

(1) Raise and support the front of the vehicle.

(2) Remove the wheel/tire.

(3) Wrap a heavy duty shop cloth (Fig. 25) or towel around the drive shaft outer rubber boot for protection while involved in the service procedure.

(4) Loosen (but do not remove) the stabilizer bar inner bracket retaining bolts at the engine cradle (Fig. 26).

(5) Remove the stabilizer bar outer bracket retaining nuts at the suspension arm and remove the bracket from the retaining bolts (Fig. 26).

The stabilizer bar outer bracket retaining nuts and bolts also retain the ball joint to the suspension arm (Fig. 26). Install a retaining nut on one of the bolts after removing the outer bracket to prevent the suspension arm from separating from the ball joint.

(6) Move the stabilizer bar away from the suspension arm (Fig. 27).

(7) Remove the retaining nut and the ball joint "pinch" bolt from the suspension knuckle (Fig. 27).

(8) Remove the nuts and bolts (at the bushings) that attach the suspension arm to the engine cradle (Fig. 28).

(9) Disengage the ball-joint stud from the suspension knuckle (Fig. 28) and remove the suspension arm from the vehicle.

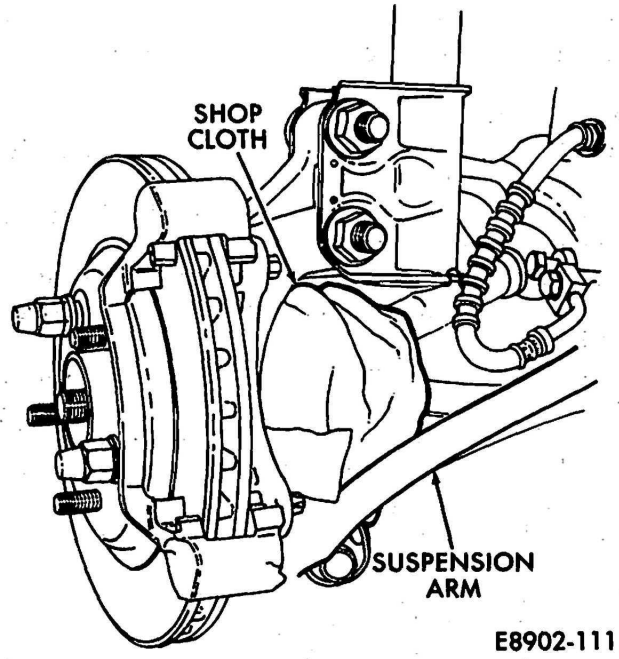


Fig. 25—Protected Drive Shaft Boot

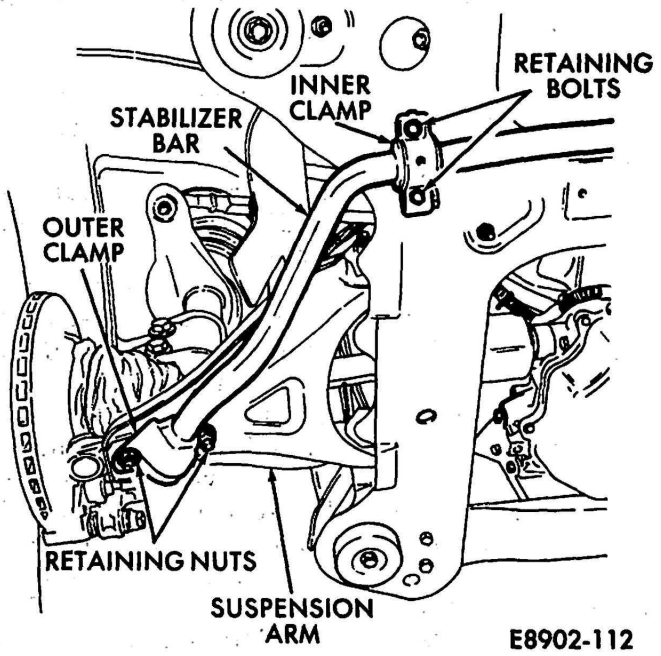


Fig. 26—Stabilizer Bar Bracket Removal

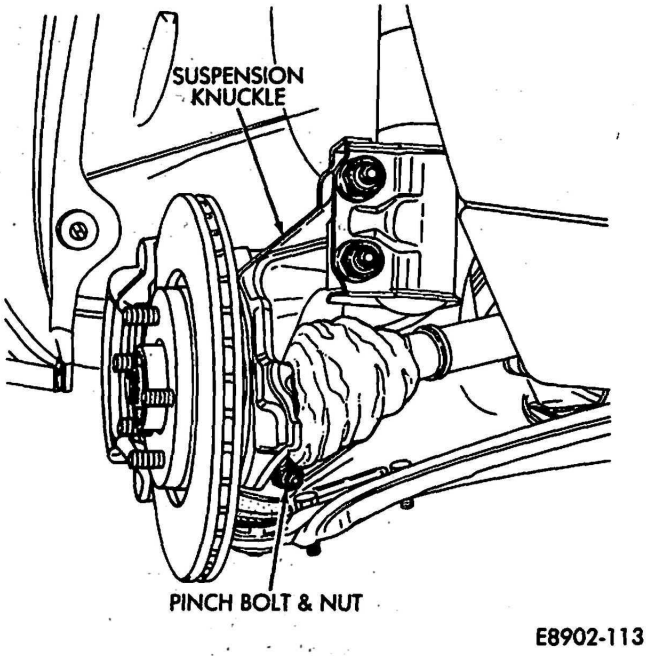


Fig. 27—Ball-Joint Removal

(10) Remove (and retain) the plastic washer from the ball stud (Fig. 28).

(11) Inspect the ball joint. Replace it if the protective rubber boot is damaged, or the ball stud is loose or defective (Fig. 28). If necessary, refer to the ball joint replacement procedure in this section of Group 2 for detailed instructions.

(12) Inspect the suspension arm bushings. Replace them if they are worn or defective. If nec-

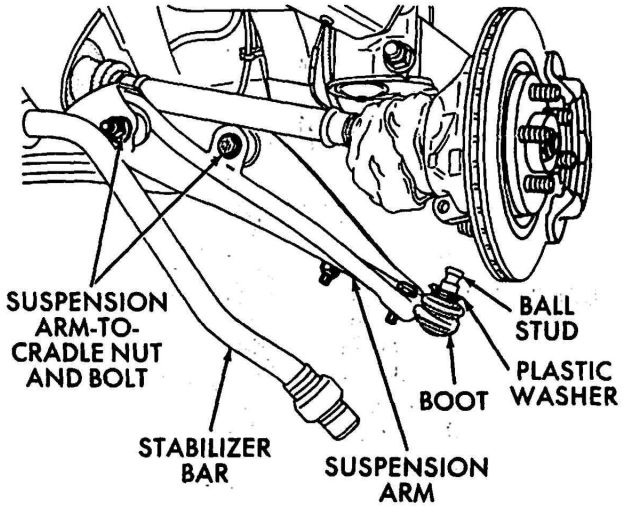


Fig. 28—Suspension Arm Removal

essary, refer to the suspension arm bushing replacement procedure in this section of Group 2 for detailed instructions.

Installation

(1) Position the suspension arm with the bushings located at the engine cradle and install the suspension arm-to-engine cradle bolts and nuts (Fig. 29).

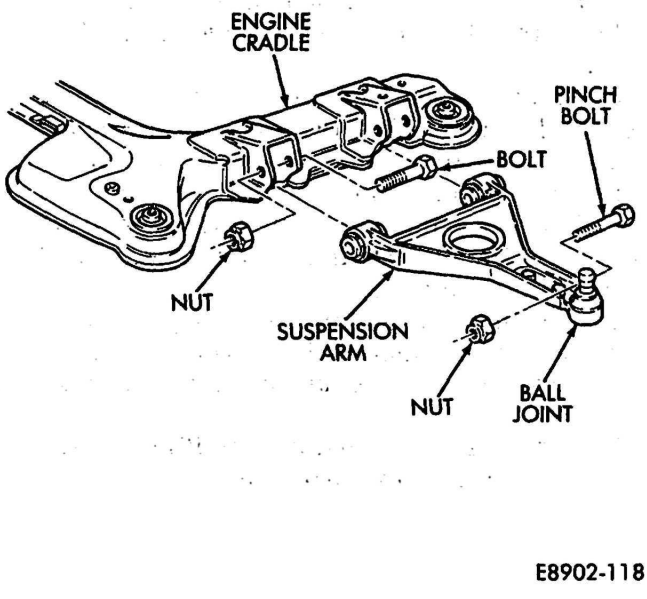


Fig. 29—Suspension Arm At Engine Cradle

Do not tighten the suspension arm-to-engine cradle attaching nuts and bolts at this time. The nuts and bolts must not be tightened with the specified torque until the vehicle is lowered and the wheels/tires are supporting the vehicle weight.

(2) Install the plastic washer on the ball stud (Fig. 30).

(3) Insert the ball stud in the suspension knuckle. Install a replacement ball stud "pinch" bolt and retaining nut (Fig. 30). Tighten the nut with 85 N·m (62 ft-lbs) torque.

Ensure that the "pinch" bolt (Fig. 30) is properly seated in the ball stud recess (i.e., keyway).

(4) Position the stabilizer bar at the suspension arm. Remove the nut from the ball joint retaining bolt. Position the outer bracket on the stabilizer bar and install the nuts on the retaining bolts (Fig. 26).

Do not tighten the retaining nuts at this time. The nuts must not be tightened with the specified torque until the vehicle is lowered and the wheels/tires are supporting the vehicle weight.

(5) Remove the shop cloth (or towel) from around the drive shaft outer rubber boot.

(6) Install the wheel/tire. Tighten steel wheel lug nuts with 75 N·m (63 ft-lbs) torque. Tighten aluminum wheel lug nuts with 122 N·m (90 ft-lbs) torque.

(7) Remove the support and lower the vehicle.

(8) With the vehicle weight being supported by the wheels/tires:

• tighten the suspension arm-to-engine cradle retaining nuts and bolts (at the bushings) with 140 N·m (103 ft-lbs) torque (Fig. 28);

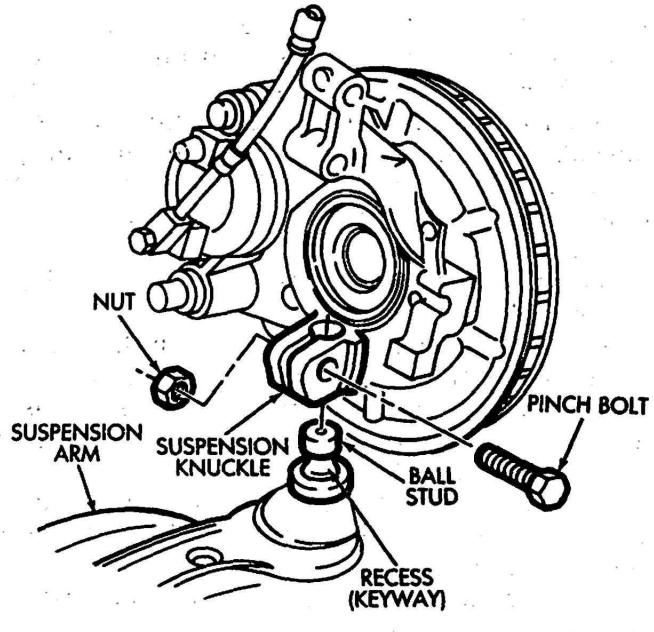


Fig. 30—Ball-Joint Stud Installation

• tighten the stabilizer bar outer bracket-to-suspension arm retaining nuts with 82 N·m (60 ft-lbs) torque (Fig. 26); and
• tigthen the stabilizer bar inner bracket-to-engine cradle retaining bolts with 28 N·m (21 ft-lbs) torque (Fig. 26).

Suspension Arm Bushings

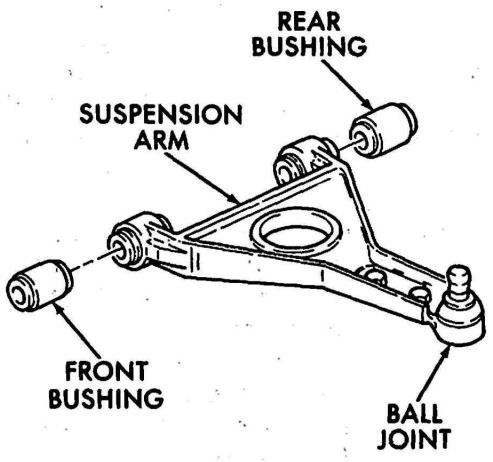


Fig. 31—Suspension Arm & Bushings

Replacement

(1) Remove the suspension arm (Fig. 31). If necessary, refer to the removal procedure in this section of Group 2 for detailed instructions.

(2) For a driver tool, position an appropriate size (34-mm or 1.34-in OD) socket wrench or steel tube on one side of the first bushing to be removed. For a receiver tool, position an appropriate size (37-mm or 1.46-in ID, or larger) on the other side of the first bushing to be removed (Fig. 32).

The outside diameter (OD) of each bushing is 36 mm (1.42 in).

(3) Place the suspension arm with the removal tools in position on an arbor (or similar type) press and force the bushing out of the suspension arm bore and into the receiver tool with the driver tool (Fig. 32).

(4) Use the same procedure described above to remove the remaining bushing from the other suspension arm bore.

The front and rear suspension arm bushings are not identical. Before installation, ensure that the bushings are correctly identified.

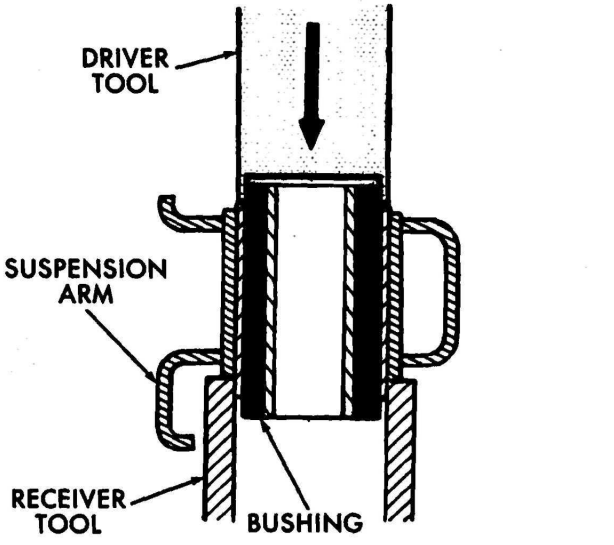


Fig. 32—Bushing Removal/Installation

(5) For a driver tool, position an appropriate size (34-mm or 1.34-in OD) socket wrench or steel tube on one side of the first bushing to be installed. For a receiver tool, position an appropriate size (37-mm or 1.46-in ID, or larger) on the other side of the first bushing to installed (Fig. 32).

CAUTION: Force each bushing into the suspension arm bore in small increments and ensure that they are centered in the bores. The distance (Fig. 33) between the two bushings (when properly installed) must be 190 mm ± 0.5 mm (7.48 in ± 0.019 in). The length of the inner protrusions (Fig. 30) must be within 5 mm (0.197 in) (preferably identical) for both bushings.

(6) Place the suspension arm with the installation tools in position (Fig. 32) on an arbor (or similar type) press and force the bushing into the suspension arm bore with the driver tool.

(7) Use the same procedure described above to install the remaining bushing in the other suspension arm bore.

Ensure that the distance/spacing between the front and rear bushing is correct and that the inner protrusions are as identical as possible (Fig. 33).

(8) Install the suspension arm. If necessary, refer to the installation procedure.

BALL JOINT

Replacement

Removal

(1) Raise and support the front of the vehicle.
(2) Remove the wheel/tire.
(3) Wrap a heavy duty shop cloth (Fig. 34) or towel around the drive shaft outer rubber boot for protection while involved in the service procedure.
(4) Loosen (but do not remove) the stabilizer bar inner bracket retaining bolts at the engine cradle (Fig. 35).
(5) Remove the stabilizer bar outer bracket retaining nuts at the suspension arm and remove the bracket from the retaining bolts (Fig. 35).
The stabilizer bar outer bracket retaining nuts and bolts also retain the ball joint to the suspension arm (Fig. 35).
(6) Move the stabilizer bar away from the suspension arm (Fig. 36).

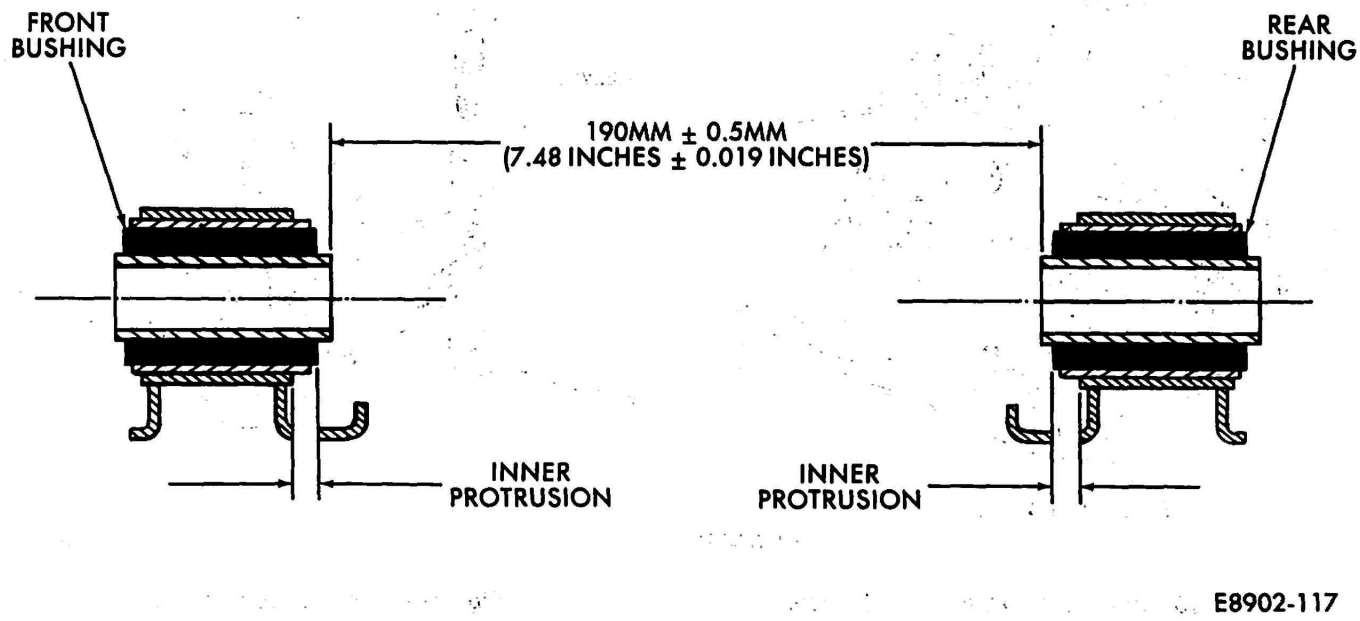


Fig. 33—Correct Bushing Installation

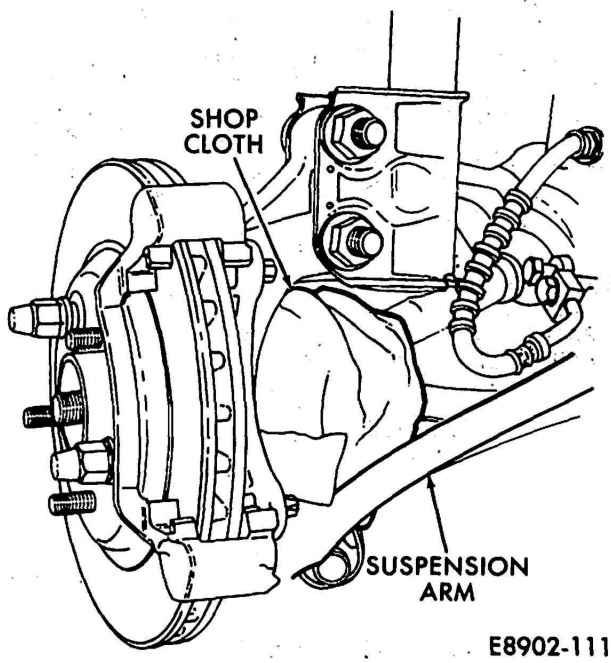


Fig. 34—Protected Drive Shaft Boot

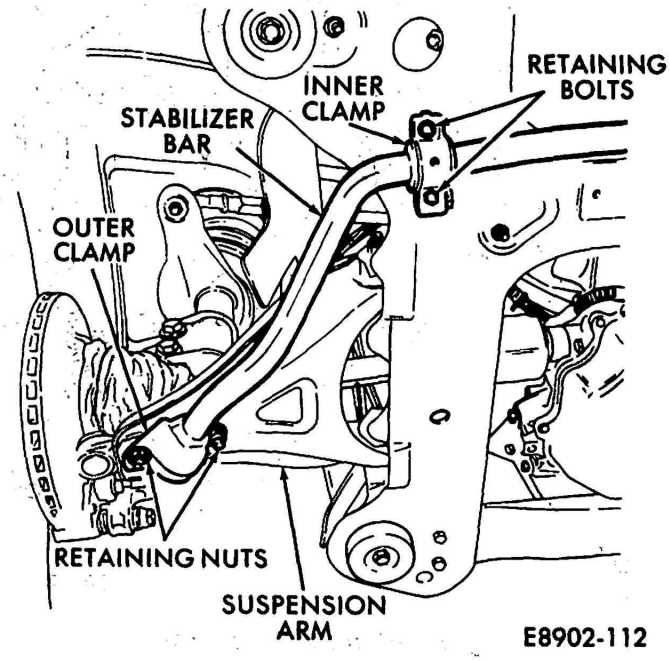


Fig. 35—Stabilizer Bar Bracket Removal

(7) Remove the retaining nut and the ball joint "pinch" bolt (Fig. 36) from the suspension knuckle.

(8) Loosen (but do not remove) the nuts and bolts (at the bushings) that attach the suspension arm to the engine cradle (Fig. 37).

(9) Disengage the ball-joint stud from the suspension knuckle (Fig. 37).

(10) Remove the plastic washer from the ball-joint stud (Fig. 37).

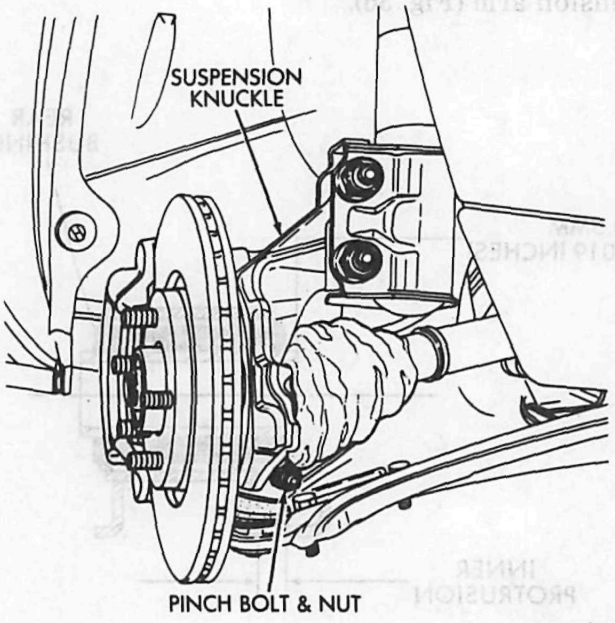


Fig. 36—Ball Joint "Pinch" bolt & Nut

(11) Remove the ball joint from the suspension arm by "tapping" upward on it with a brass or plastic mallet (Fig. 37).

Installation

(1) Position the replacement ball joint on the suspension arm (Fig. 38). Install and crimp the sleeves, and install the retaining bolts and nuts (Fig. 38). Do not tighten the nuts (Fig. 39).

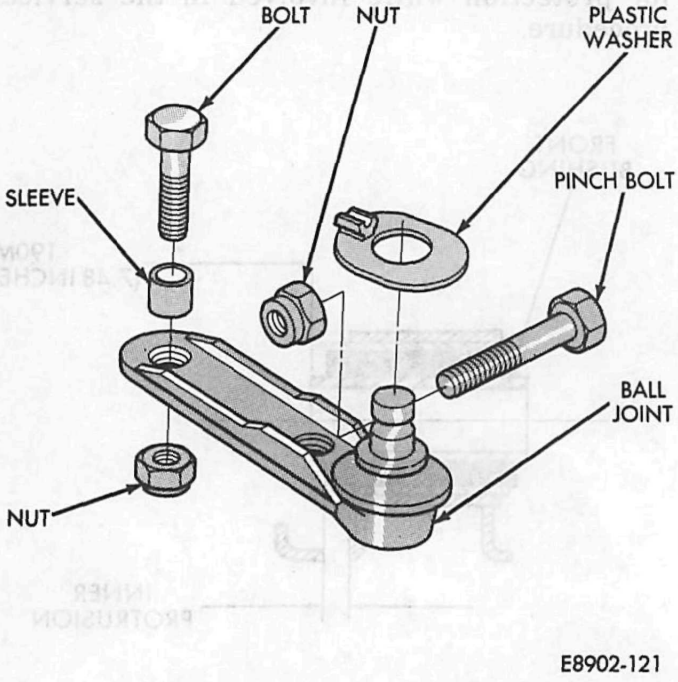


Fig. 38—Replacement Ball Joint

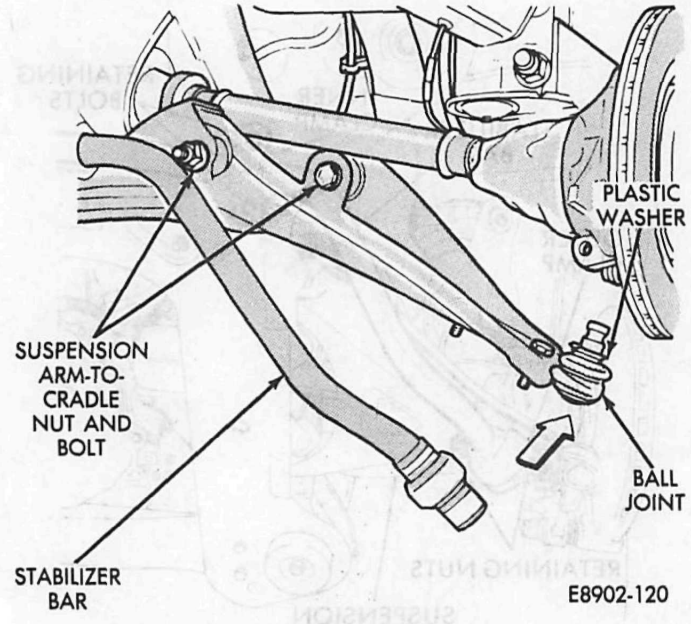


Fig. 37—Ball Joint Removal

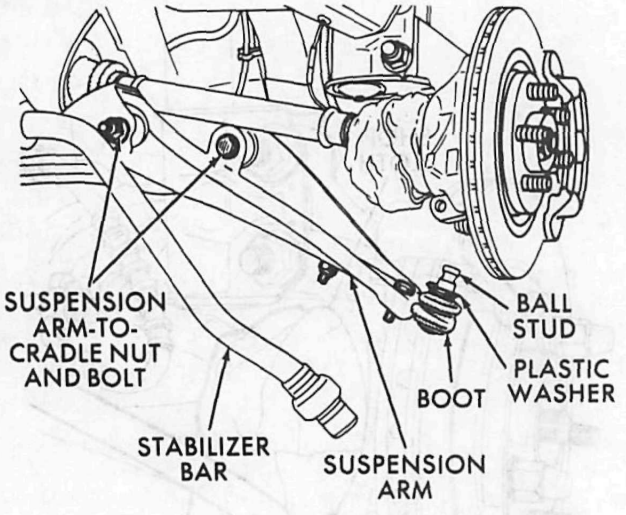


Fig. 39—Ball Joint Installation

(2) Install the replacement plastic washer on the ball-joint stud. (Fig. 38, Fig. 39).

(3) Insert the ball-joint stud in the suspension knuckle. Install the ball joint "pinch" bolt and retaining nut (Fig. 40). Tighten the nut with 105 N·m (77 ft-lbs) torque.

Ensure that the "pinch" bolt (Fig. 40) is properly seated in the ball-joint stud recess (i.e., "keyway").

(4) Remove the ball joint retaining nuts and position the stabilizer bar at the suspension arm. Position the outer bracket on the stabilizer bar and install the retaining nuts on the retaining bolts (Fig. 35).

Do not tighten the retaining nuts at this time. The nuts must not be tightened with the specified torque until the vehicle is lowered and the wheels/tires are supporting the weight of the vehicle.

(5) Remove the shop cloth (or towel) from around the drive shaft outer rubber boot.

(6) Install the wheel/tire. Tighten steel wheel lug nuts with 85 N·m (63 ft-lbs) torque. Tighten aluminum wheel lug nuts with 122 N·m (90 ft-lbs) torque.

(7) Remove the support and lower the vehicle.

(8) With the vehicle weight being supported by the wheels/tires:

- tighten the suspension arm-to-engine cradle nuts and bolts (at the bushings) with 140 N·m (103 ft-lbs) torque (Fig. 37).
- Tighten the stabilizer bar outer bracket retaining nuts with 82 N·m (60 ft-lbs) torque (Fig. 35) and
- tighten the stabilizer bar inner bracket retaining bolts with 28 N·m (21 ft-lbs) torque (Fig. 35).

FRONT WHEEL HUB AND BEARING

Service Information

The front wheel hub can be removed without removing the bearing from the suspension knuckle. However, the wheel hub must be removed before the bearing can be removed from the suspension knuckle. The wheel hub and bearing are independently replaceable.

When servicing the suspension knuckle, the wheel hub and bearing can and should be removed as a unit. Refer to the suspension knuckle removal and installation procedures in this section of Group 2 for detailed instructions.

Although the wheel bearing components can be disassembled for inspection, the bearing must be replaced as a unit only. If any of the bearing components are worn, damaged or defective, the complete bearing must be replaced.

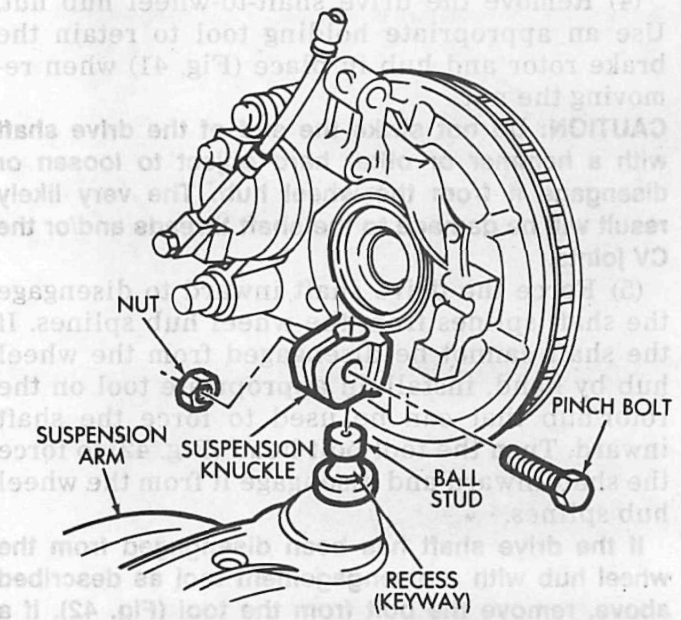


Fig. 40—Ball-Joint Stud Installation

Wheel Hub Removal

(1) Raise and support the front of the vehicle.

(2) Remove the wheel/tire.

CAUTION: Do not allow the brake hose to support the weight of the caliper. Attach the caliper to the vehicle chassis or body with twine or a wire hanger.

(3) Remove the brake caliper. Do not disconnect the brake hose from the caliper. If necessary, refer to the caliper removal procedure on Group 5 for detailed instructions.

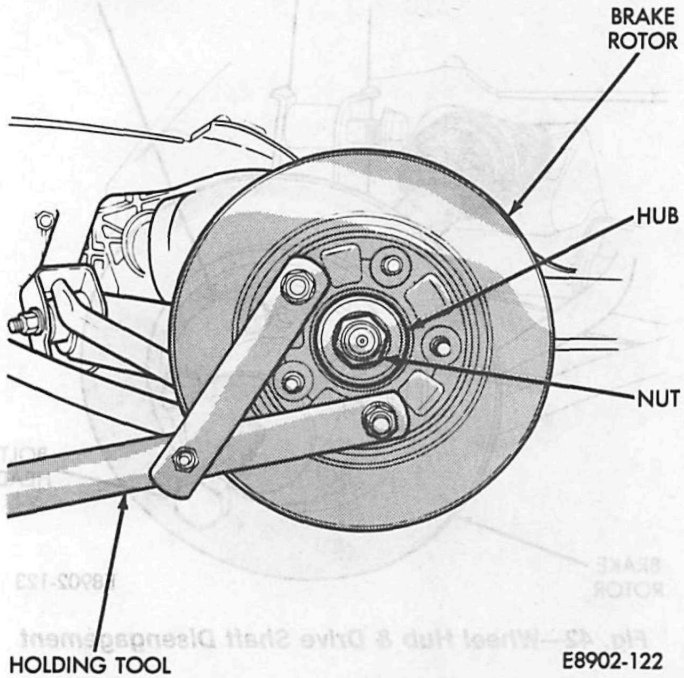


Fig. 41—Drive Shaft-To-Wheel Hub Nut Removal

(4) Remove the drive shaft-to-wheel hub nut. Use an appropriate holding tool to retain the brake rotor and hub in place (Fig. 41) when removing the nut.

CAUTION: Do not strike the end of the drive shaft with a hammer or other hard object to loosen or disengage it from the wheel hub. The very likely result will be damage to the shaft threads and/or the CV joints.

(5) Force the drive shaft inward to disengage the shaft splines from the wheel hub splines. If the shaft cannot be disengaged from the wheel hub by hand, install an appropriate tool on the rotor/hub that can be used to force the shaft inward. Turn the tool bolt head (Fig. 42) to force the shaft inward and disengage it from the wheel hub splines.

If the drive shaft has been disengaged from the wheel hub with a disengagement tool as described above, remove the bolt from the tool (Fig. 42). If a tool was not required for disengagement of the drive shaft, install a hub removal tool on the rotor/hub that can be used with a slide hammer (Fig. 43) to remove the hub from the suspension knuckle.

Do not remove the brake rotor before the wheel hub is removed from the suspension knuckle. They must be removed simultaneously, otherwise the removal tool will not fit properly on the wheel hub.

(6) Remove the rotor/hub from the suspension knuckle with an appropriate removal tool and a slide hammer (Fig. 43).

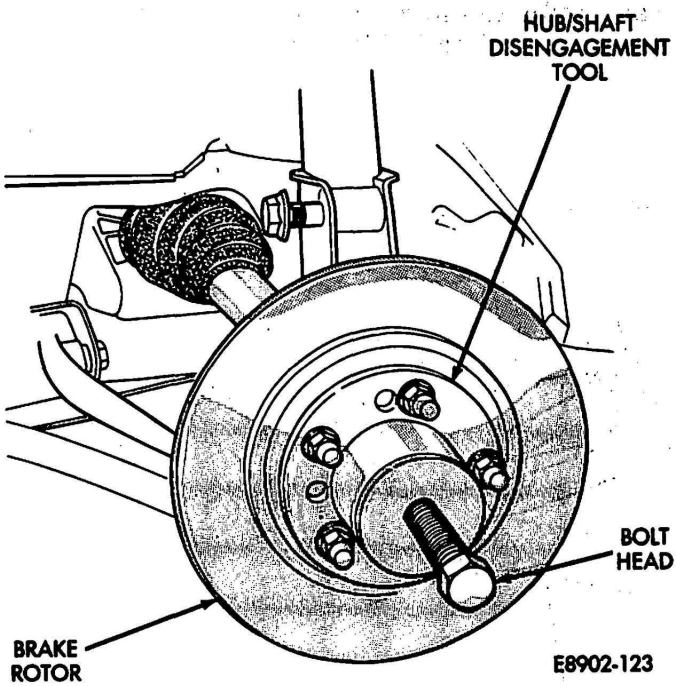


Fig. 42—Wheel Hub & Drive Shaft Disengagement

CAUTION: Care must be taken to prevent any foreign material from getting into the bearing.

(7) After removing the rotor/hub from the suspension knuckle, if necessary, the brake rotor (Fig. 44) can be easily separated from the wheel hub. Remove the rotor safety nuts (Fig. 44) and separate the rotor from the wheel hub.

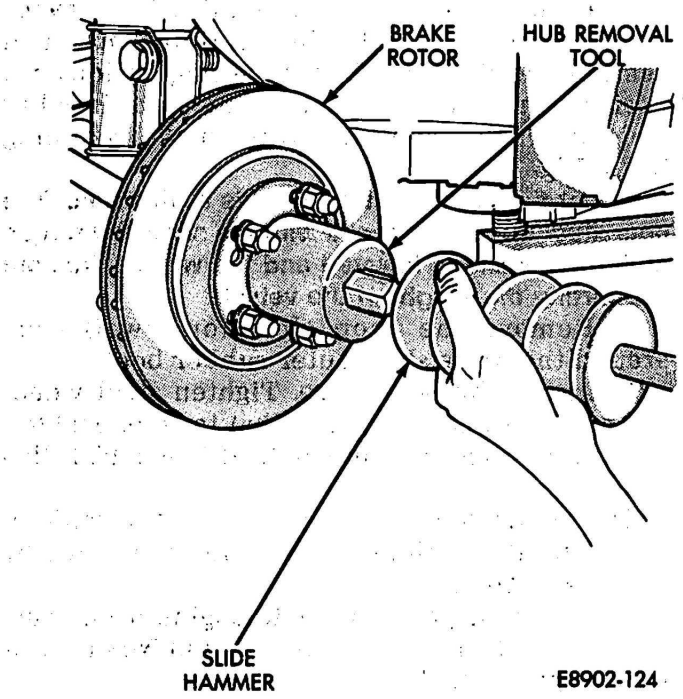


Fig. 43—Rotor/Hub Removal

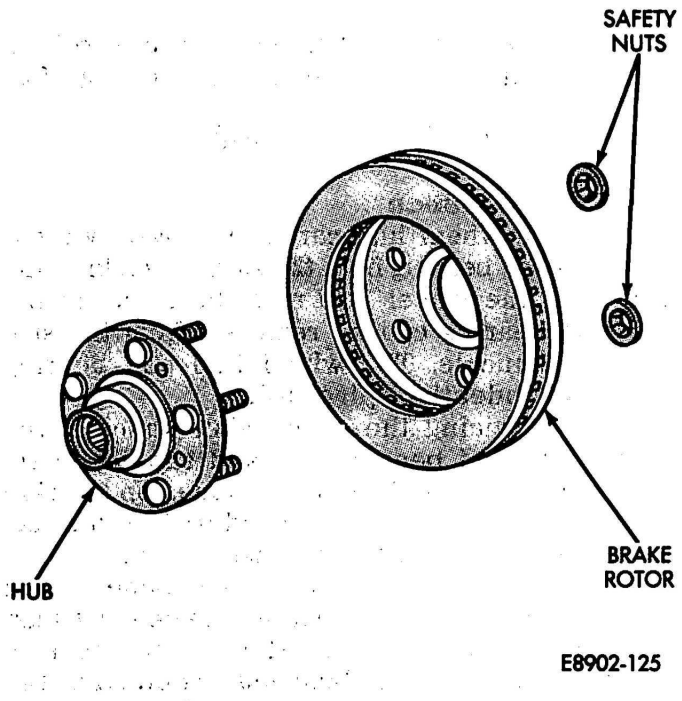


Fig. 44—Wheel Hub, Rotor & Safety Nuts

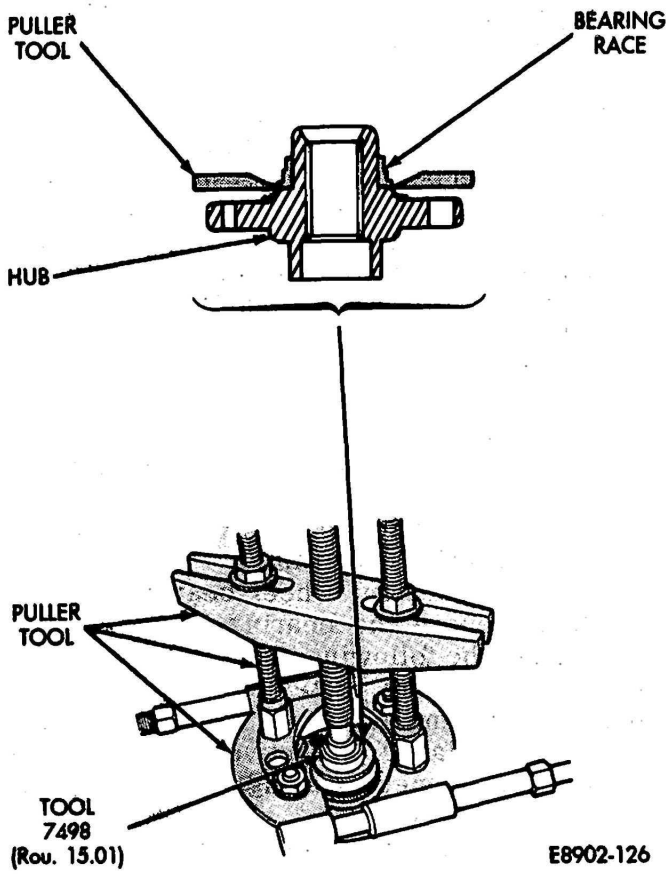


Fig. 45—Bearing Outer Race Removal

If the safety nuts are damaged during removal, they must be replaced. Do not reuse the original nuts if they are defective or damaged.

(8) If the wheel hub must be replaced, remove the bearing outer race from the hub with a shop press, Puller Thrust Pad Tool 7498 (Rou. 15.01) and an appropriate bearing puller tool (Fig. 45).

Wheel Hub Installation

(1) If a replacement wheel hub is being installed, force the original bearing outer race on the replacement hub (Fig. 46) with a shop press and a suitable length of steel tube (Fig. 47) that has the correct inside diameter (ID) to fit around the hub.

(2) Lubricate the bearing mating surface (Fig. 48) on the wheel hub bearing outer race with an EP (extreme pressure) type wheel bearing lubricant.

(3) Position the wheel hub on the drive shaft and insert the hub into the wheel bearing (Fig. 48).

(4) "Tap" the wheel hub with a brass hammer until three or four of the drive shaft threads extend outward beyond the hub.

(5) If removed, install the brake rotor on the wheel hub. If necessary, use replacement safety nuts (Fig. 44).

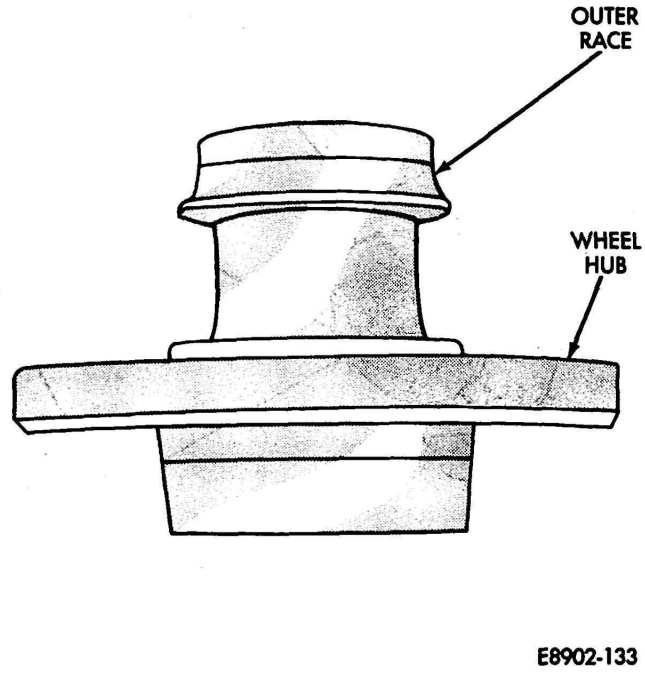


Fig. 46—Bearing Outer Race & Wheel Hub

CAUTION: Do not use an impact wrench to tighten the drive shaft-to-wheel hub nut, use a torque wrench only to tighten the nut. It is also essential that the drive shaft-to-wheel hub nut be tightened with the specified tightening torque. In addition to retaining the wheel hub on the drive shaft, the specified torque also established the wheel bearing "preload".

(6) Install the drive shaft-to-wheel hub nut. Use an appropriate holding tool to retain the brake rotor and hub in place (Fig. 49) while tightening the nut with 245 N· (181 ft-lbs) torque.

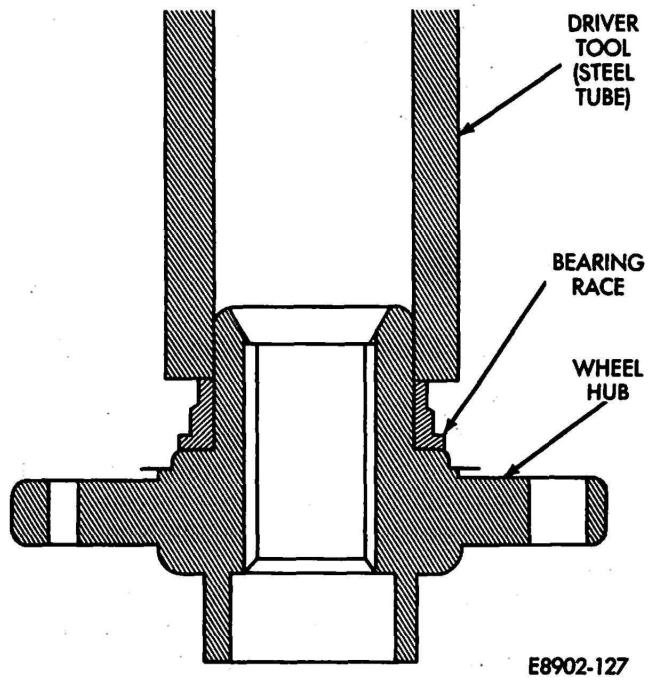


Fig. 47—Bearing Outer Race Installation

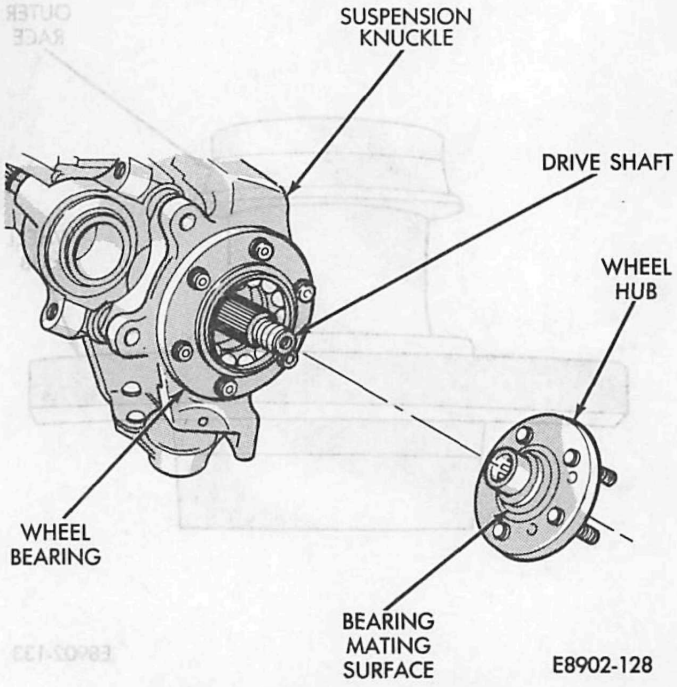


Fig. 48—Wheel Hub Installation

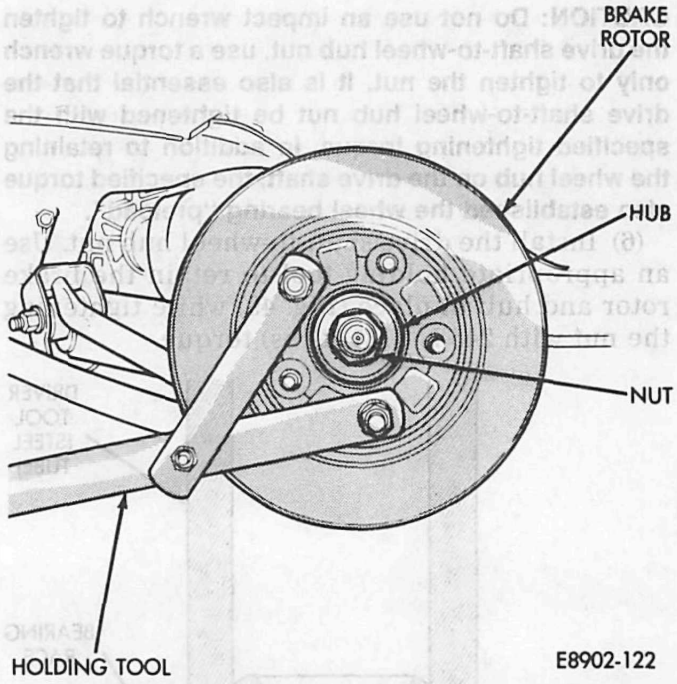


Fig. 49—Drive Shaft-To-Wheel Hub Nut Installation

(7) Install the brake caliper. If necessary, refer to Group 5 for the installation procedure.

(8) Install the wheel/tire. Tighten steel wheel lug nuts with 85 N·m (63 ft-lbs) torque. Tighten aluminum wheel lug nuts with 122 N·m (90 ft-lbs) torque.

(9) Remove the support and lower the vehicle.

(10) Depress the brake pedal several times to seat the brake pads before moving the vehicle.

Bearing Removal

(1) Remove the front wheel hub. If necessary, refer to the removal procedure in this section of Group 2 for detailed instructions.

(2) Remove the Torx-head bolts (Fig. 50) that attach the wheel bearing to the suspension knuckle and remove the bearing.

(3) If the bearing must be replaced, remove the bearing outer race from the original wheel hub with a shop press, Puller Thrust Pad Tool 7498 (Rou. 15.01) and an appropriate bearing puller tool (Fig. 51).

Bearing Installation

(1) If the original wheel bearing is being installed, pack the bearing and lubricate both races (inner and outer) with an EP (extreme pressure) type wheel bearing lubricant.

(2) If a replacement wheel bearing is being installed, prepare the bearing for installation according to the following instructions:

- remove the plastic protective covers (Fig. 52) from the replacement bearing and discard them;
- remove the plastic protective sleeve (Fig. 53) from the replacement bearing bore and discard it;
- remove the inner and the outer bearing races (Fig. 54) from the replacement bearing;
- pack the replacement bearing with the lubricant supplied in the replacement bearing kit;
- insert the bearing inner race in the replacement bearing; and

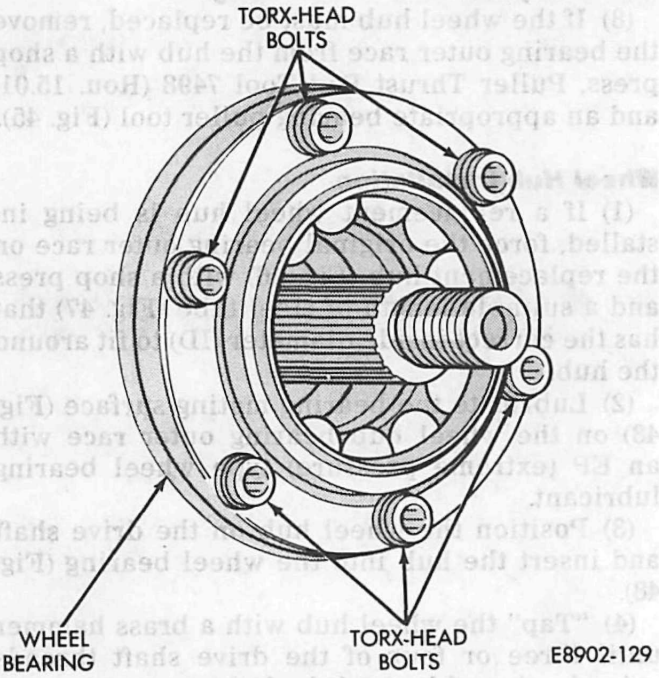


Fig. 50—Wheel Bearing Removal

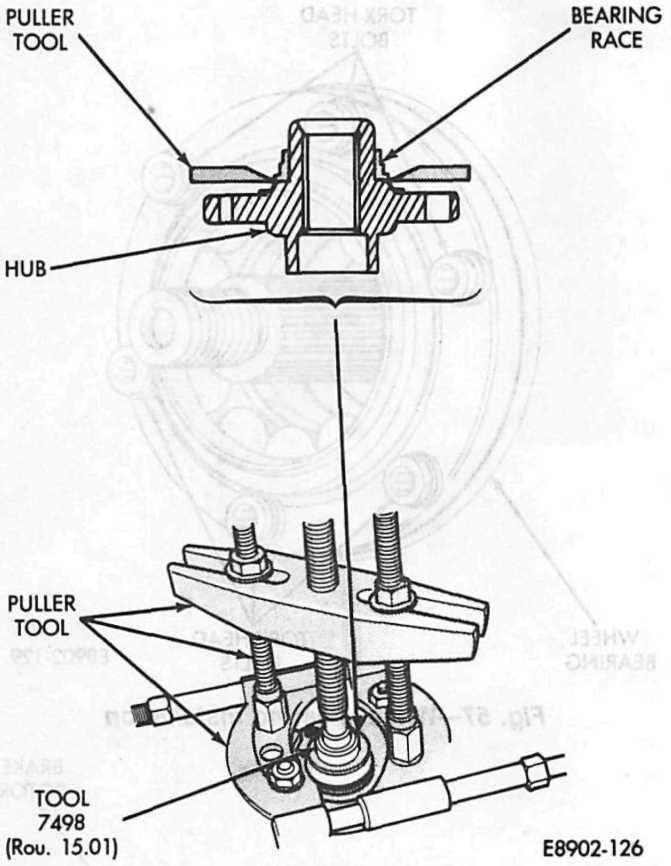


Fig. 51—Bearing Outer Race Removal

• force the bearing outer race on the original wheel hub (Fig. 51) with a shop press and a suitable length of steel tube (Fig. 56) that has the correct inside diameter (ID) to fit around the hub.

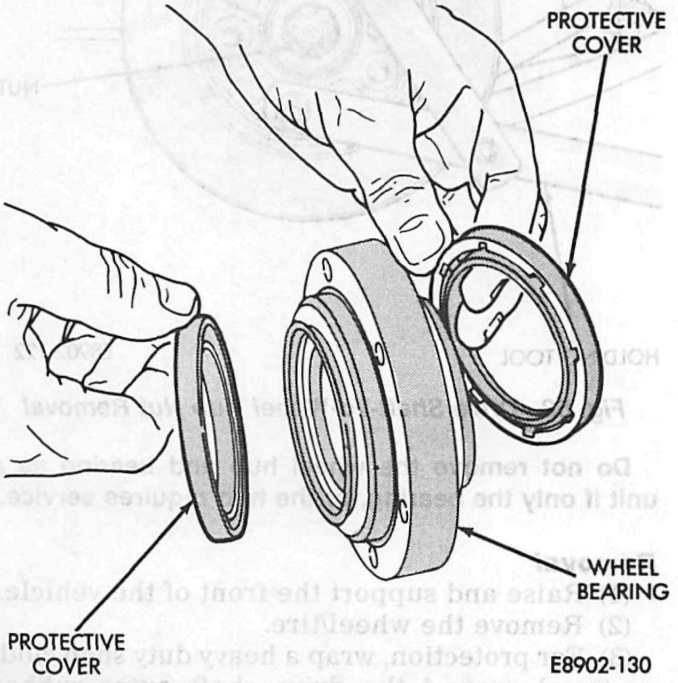


Fig. 52—Bearing Protective Covers

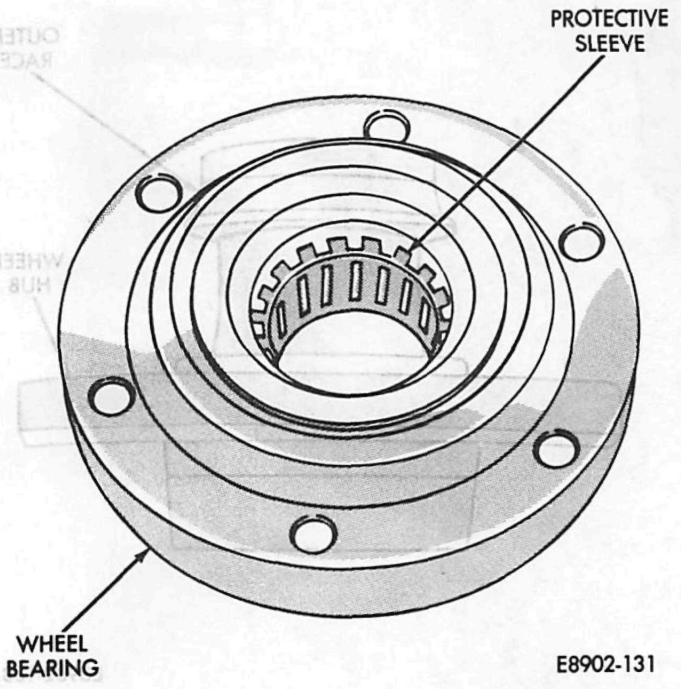


Fig. 53—Bearing Bore Protective Sleeve

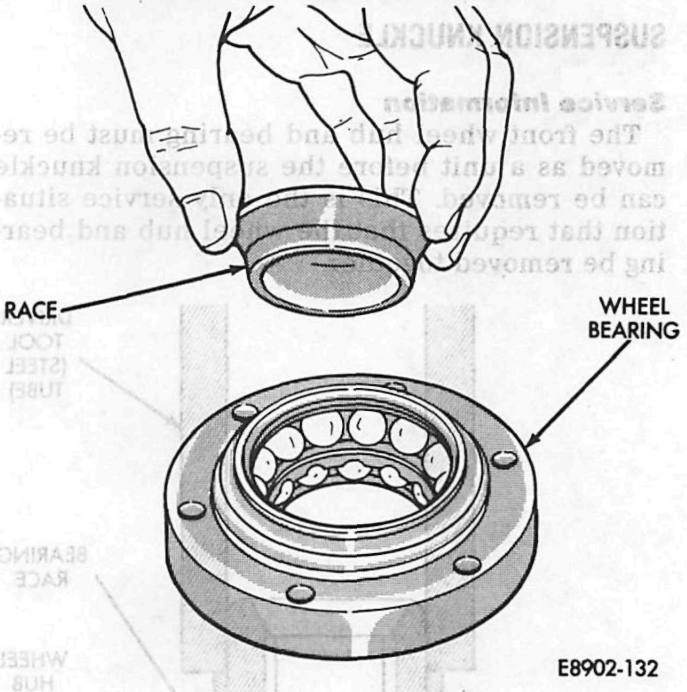


Fig. 54—Bearing & Race

(3) Install the bearing in the suspension knuckle (Fig. 63).

(4) Install and tighten the bearing-to-suspension knuckle Torx-head bolts (Fig. 57) with 15 N·m (11 ft-lbs) torque.

(5) Install the front wheel hub. If necessary, refer to the installation procedure in this section of Group 2 for detailed instructions.

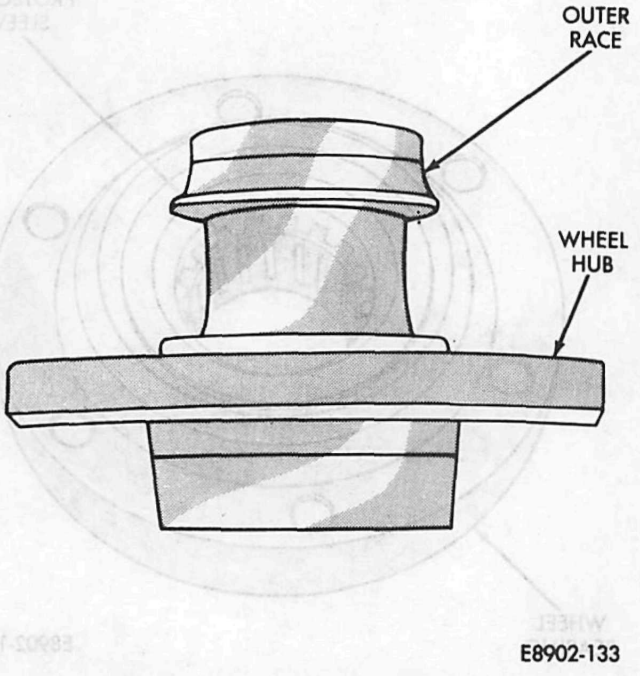


Fig. 55—Bearing Outer Race & Wheel Hub

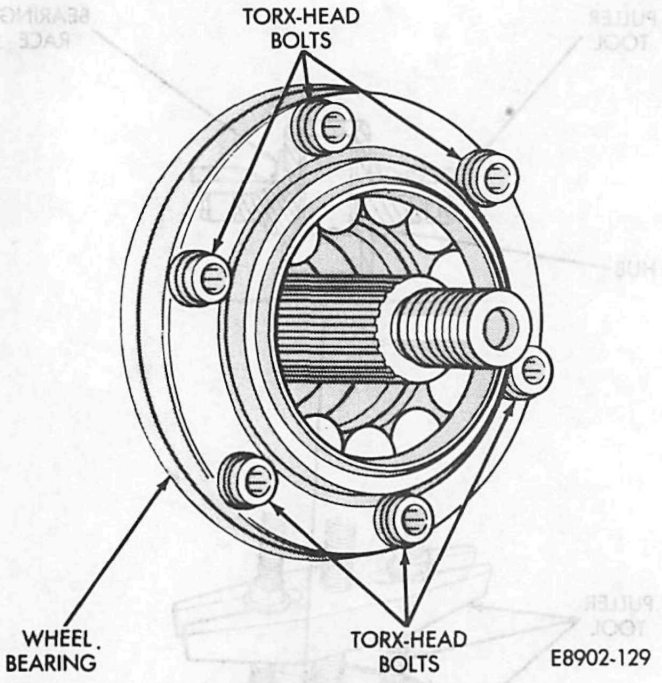


Fig. 57—Wheel Bearing Installation

SUSPENSION KNUCKLE

Service Information

The front wheel hub and bearing must be removed as a unit before the suspension knuckle can be removed. This is the only service situation that requires that the wheel hub and bearing be removed together.

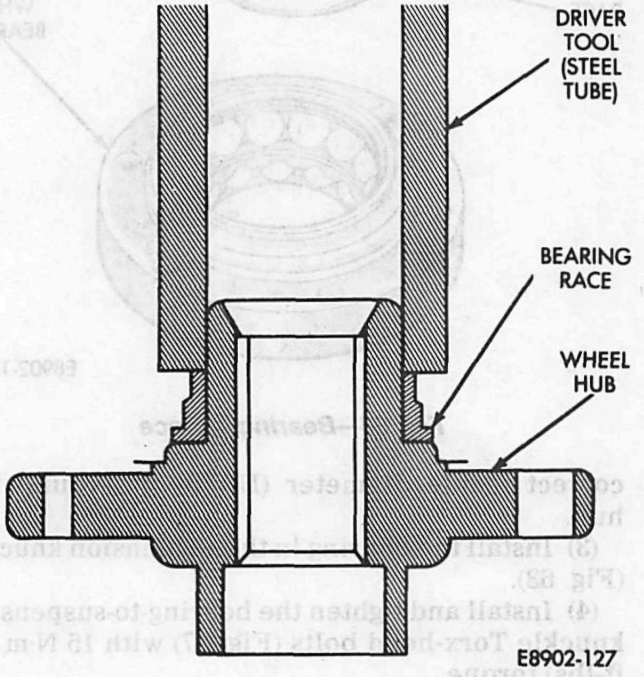


Fig. 56—Bearing Outer Race Installation

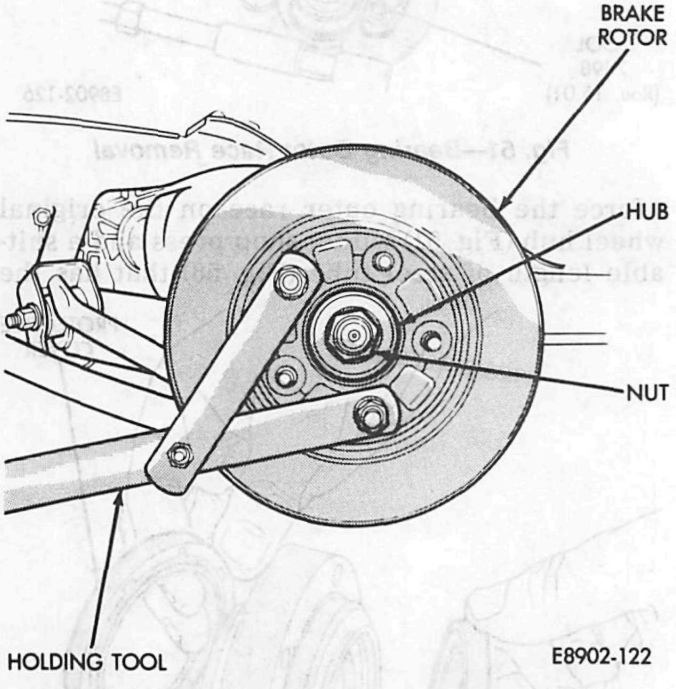


Fig. 58—Drive Shaft-To-Wheel Hub Nut Removal

Do not remove the wheel hub and bearing as a unit if only the bearing, or the hub requires service.

Removal

(1) Raise and support the front of the vehicle.
(2) Remove the wheel/tire.
(3) For protection, wrap a heavy duty shop cloth or towel around the drive shaft outer rubber boot.

CAUTION: Do not allow the brake hose to support the caliper weight. Attach the caliper to the vehicle chassis or body with twine or a wire hanger.

(4) Remove the brake caliper. Do not disconnect the brake hose from the caliper. If necessary, refer to the caliper removal procedure in Group 5 for detailed instructions.

(5) Remove the drive shaft-to-wheel hub nut. Use an appropriate holding tool to retain the brake rotor and hub in place (Fig. 58) while removing the nut.

CAUTION: Do not strike the end of the drive shaft with a hammer or other hard object to loosen or disengage it from the wheel hub. The very likely result will be damage to the shaft threads and/or the CV joints.

(6) Force the drive shaft inward to disengage the shaft splines from the wheel hub splines. If the shaft cannot be disengaged from the wheel hub by hand, install an appropriate tool on the rotor/hub that can be used to force the shaft inward. Turn the tool bolt head (Fig. 59) to force the shaft inward and disengage it from the wheel hub splines.

If the drive shaft has been disengaged from the wheel hub with a disengagement tool as described above, remove the tool (Fig. 59).

(7) Remove the safety nuts and remove the rotor (Fig. 60) from the wheel hub.

If the safety nuts are damaged during removal, they must be replaced. Do not reuse the original nuts if they are defective or damaged.

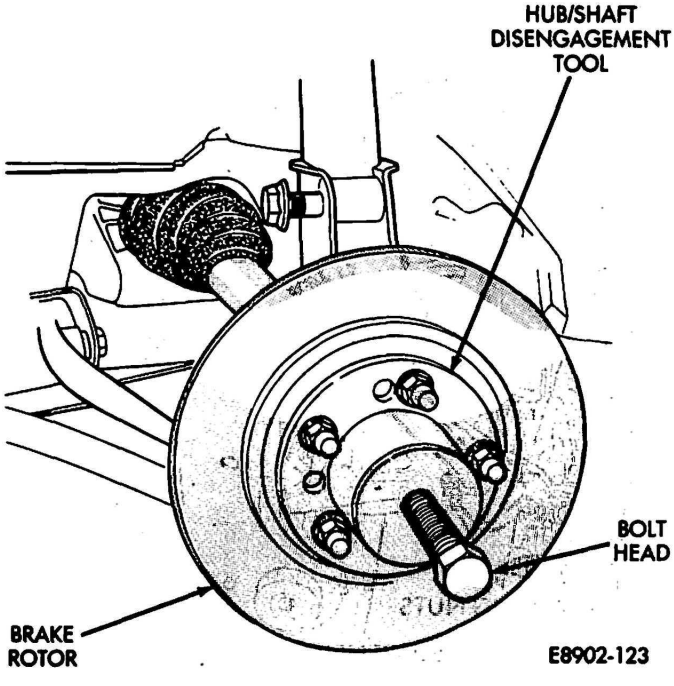


Fig. 59—Wheel Hub & Drive Shaft Disengagement

(8) Rotate the wheel hub as necessary and use the access hole in the hub to remove each wheel bearing-to-suspension knuckle Torx-head bolt (Fig. 61).

(9) Install brake rotor on the wheel hub, otherwise the hub and bearing removal tool will not fit properly on the hub.

(10) Install an appropriate removal tool on the rotor/hub that can be used with a slide hammer (Fig. 62) to remove the rotor, the wheel hub and the bearing from the suspension knuckle as a unit.

(11) Remove the rotor, wheel hub and bearing from the suspension knuckle with the removal tool and a slide hammer (Fig. 62).

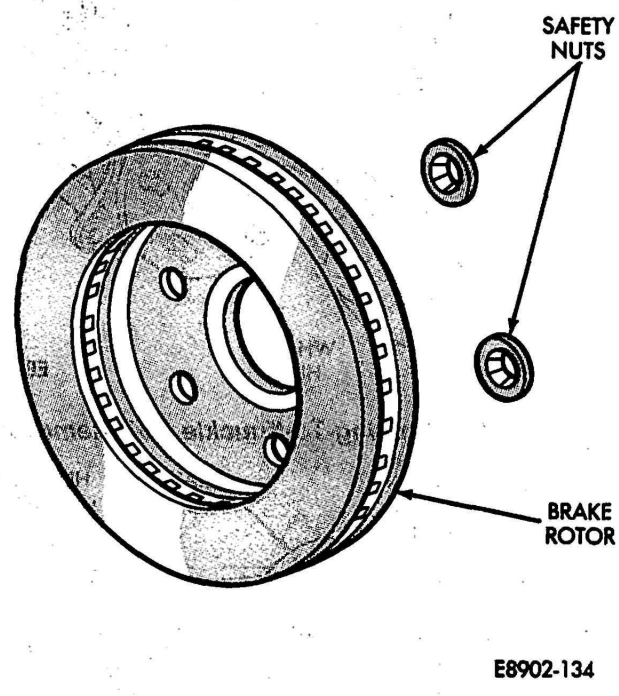


Fig. 60—Brake Rotor & Safety Nuts

(12) Loosen (but do not remove) the stabilizer bar inner bracket retaining bolts at the engine cradle (Fig. 69).

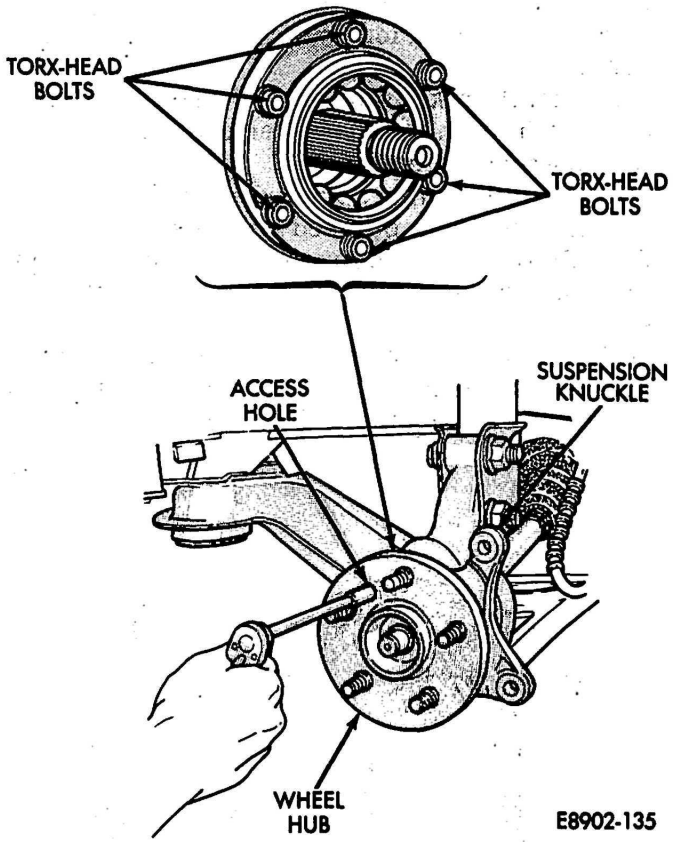


Fig. 61—Bearing-To-Knuckle Bolt Removal

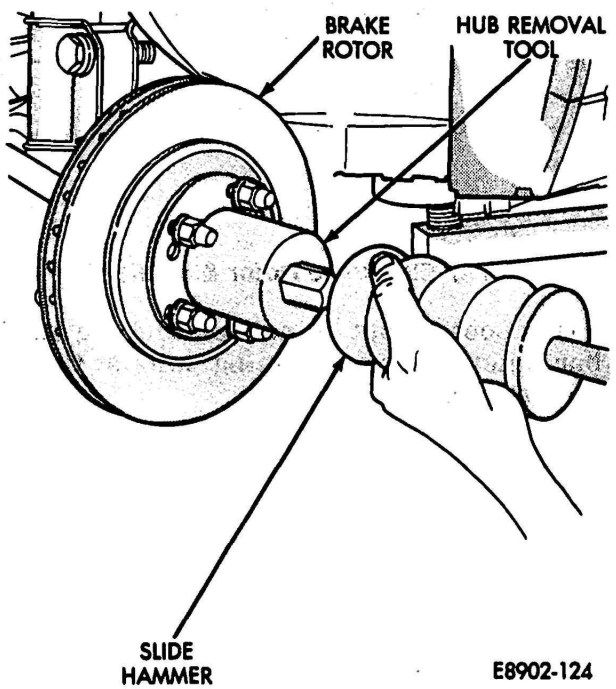


Fig. 62—Rotor, Wheel Hub & Bearing Removal

(13) Remove the stabilizer bar outer bracket retaining nuts at the suspension arm and remove the bracket from the retaining bolts (Fig. 63).

The stabilizer bar outer bracket retaining nuts and bolts also retain the ball joint to the suspension arm (Fig. 63).

(14) Move the stabilizer bar away from the suspension arm. Install one of the nuts on either of the ball joint retaining bolts.

(15) Loosen (but do not remove) the nuts and bolts (at the bushings) that attach the suspension arm to the engine cradle.

(16) Remove the ball-joint stud "pinch" bolt (Fig. 64) and disengage the ball-joint stud from the suspension knuckle.

The strut body-to-suspension knuckle bolts are "splined" (Fig. 65). Remove the bolts only as instructed in the procedure below.

(17) Remove the two "splined" bolts that attach the strut body to the suspension knuckle (Fig. 64, Fig. 65) according to the following instructions:

- loosen the nuts (Fig. 64).
- turn the nuts until they are almost at the end of the bolt threads,
- "tap" the nuts with a brass hammer to loosen the bolts and disengage the splines (Fig. 65), and
- remove the nuts and slide the bolts out of the strut body and the suspension knuckle.

(18) Remove the suspension knuckle from the drive shaft.

Installation

(1) Position the suspension knuckle over the drive shaft. Insert the ball-joint stud (Fig. 66) in the suspension knuckle and install the ball-joint stud "pinch" bolt and nut. Tighten the nut with 105 N·m (77 ft-lbs) torque.

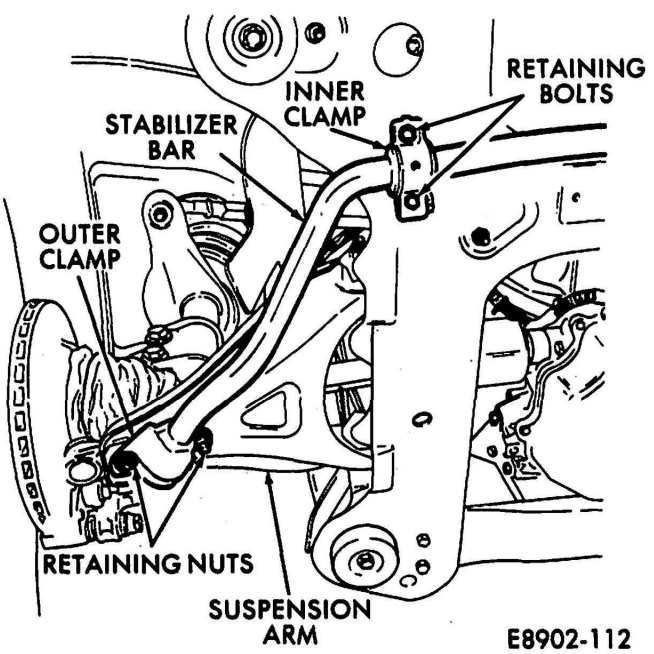


Fig. 63—Stabilizer Bar Bracket Removal

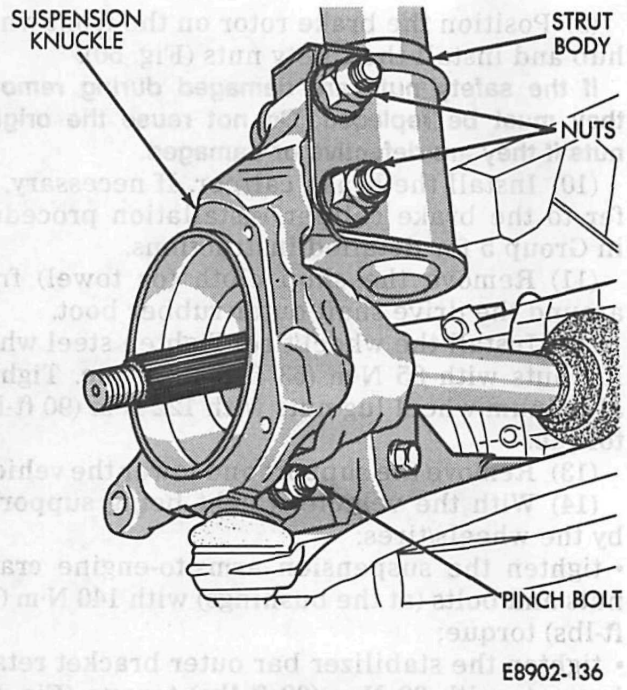


Fig. 64—Ball-Joint Stud & Strut Body Removal

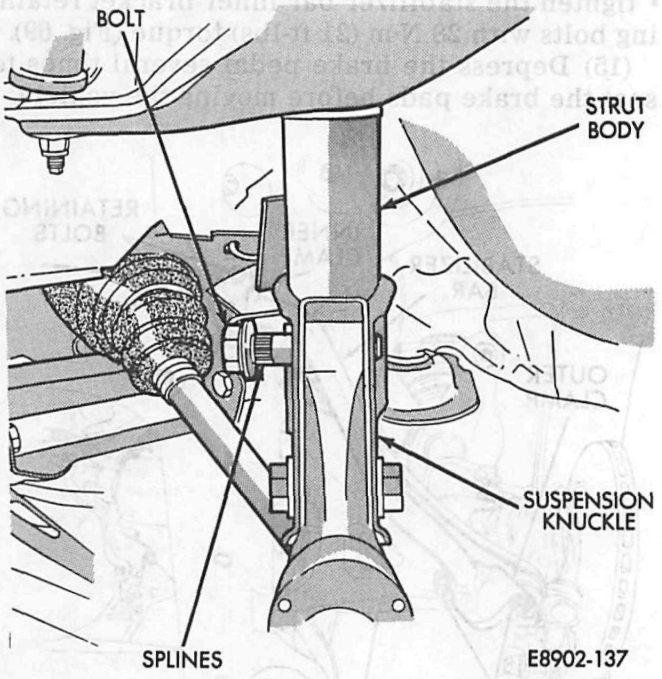


Fig. 65—Strut Body-To-Knuckle Bolt Removal

Ensure that the "pinch" bolt is seated properly in the machined recess (i.e., "keyway") in the ball-joint stud (Fig. 66).

(2) Position the suspension knuckle in the strut body (Fig. 67).

(3) Install the strut body-to-suspension knuckle bolts and nuts (Fig. 67).

Ensure that the bolt splines (Fig. 67) are properly aligned in the strut body holes before "tapping" the bolts into position and installing the nuts. Retain each bolt head in place with a wrench when tightening the nut.

(4) Remove the ball joint retaining nut and position the stabilizer bar at the suspension arm. Position the outer bracket on the stabilizer bar and install the retaining nuts on the retaining bolts (Fig. 63).

Do not tighten the retaining nuts at this time. The nuts must not be tightened with the specified torque until the vehicle is lowered and the wheels/tires are supporting the weight of the vehicle.

(5) Position the wheel bearing and hub over the drive shaft and insert them into the suspension knuckle with the hub splines mated with the drive shaft splines.

(6) Remove the brake rotor from the wheel hub.

(7) Rotate the wheel hub as necessary and use the access hole in the hub to install each wheel bearing-to-suspension knuckle Torx-head bolt (Fig. 61) Tighten the bolts with 15 N·m (11 ft-lbs) torque.

CAUTION: Do not use an impact wrench to tighten the drive shaft-to-wheel hub nut, use a torque wrench only to tighten the nut. It is also essential that the drive shaft-to-wheel hub nut be tightened with the specified tightening torque. In addition to retaining the wheel hub on the drive shaft, the specified torque also establishes the wheel bearing "preload".

(8) Install the drive shaft-to-wheel hub nut. Use an appropriate holding tool to retain the brake rotor and wheel hub in place (Fig. 68) while tightening the nut with 245 N·m (181 ft-lbs) torque.

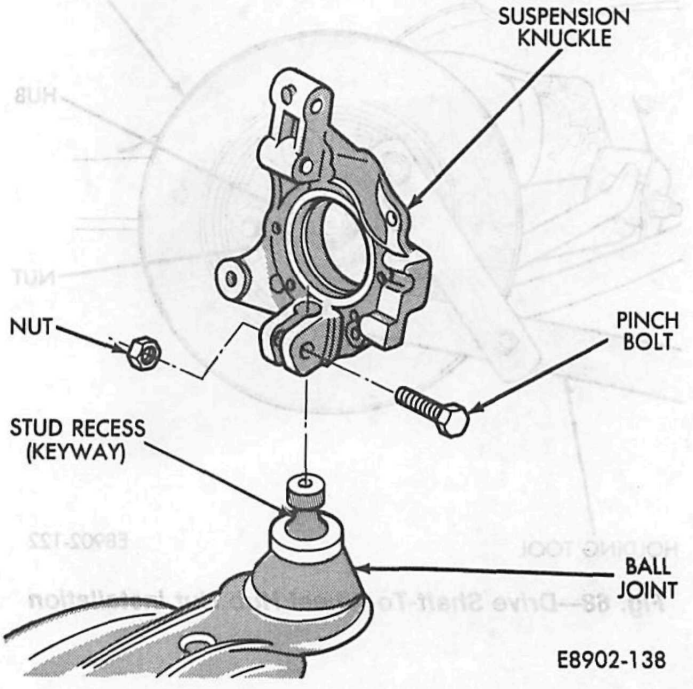


Fig. 66—Suspension Knuckle Installation

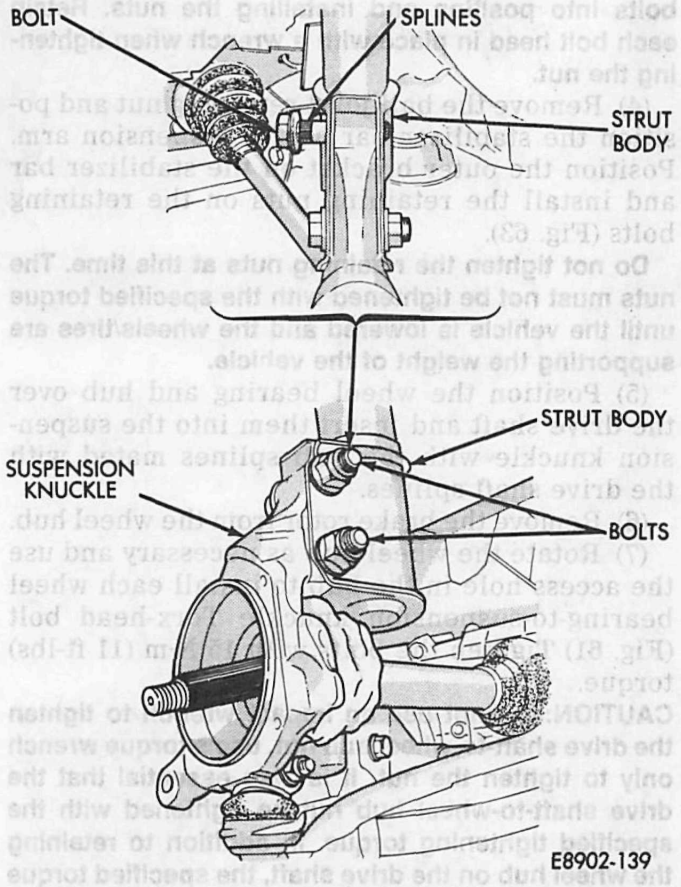


Fig. 67—Strut Body-To-Knuckle Bolt Installation

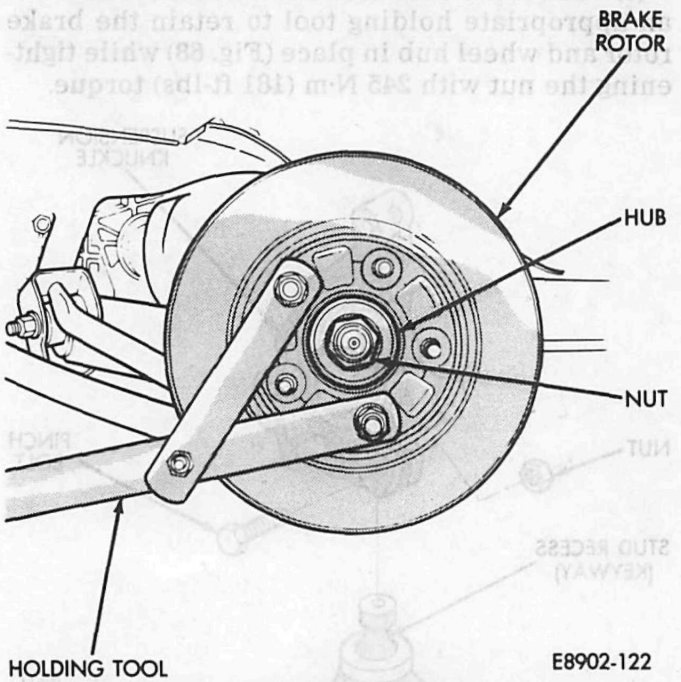


Fig. 68—Drive Shaft-To-Wheel Hub Nut Installation

(9) Position the brake rotor on the front wheel hub and install the safety nuts (Fig. 60).

If the safety nuts are damaged during removal, they must be replaced. Do not reuse the original nuts if they are defective or damaged.

(10) Install the brake caliper. If necessary, refer to the brake caliper installation procedure in Group 5 for detailed instructions.

(11) Remove the shop cloth (or towel) from around the drive shaft outer rubber boot.

(12) Install the wheel/tire. Tighten steel wheel lug nuts with 85 N·m (63 ft-lbs) torque. Tighten aluminum wheel lug nuts with 122 N·m (90 ft-lbs) torque.

(13) Remove the support and lower the vehicle.

(14) With the vehicle weight being supported by the wheels/tires:

- tighten the suspension arms-to-engine cradle nuts and bolts (at the bushings) with 140 N·m (103 ft-lbs) torque;
- tighten the stabilizer bar outer bracket retaining nuts with 82 N·m (60 ft-lbs) torque (Fig. 69); and
- tighten the stabilizer bar inner bracket retaining bolts with 28 N·m (21 ft-lbs) torque (Fig. 69).

(15) Depress the brake pedal several times to seat the brake pads before moving the vehicle.

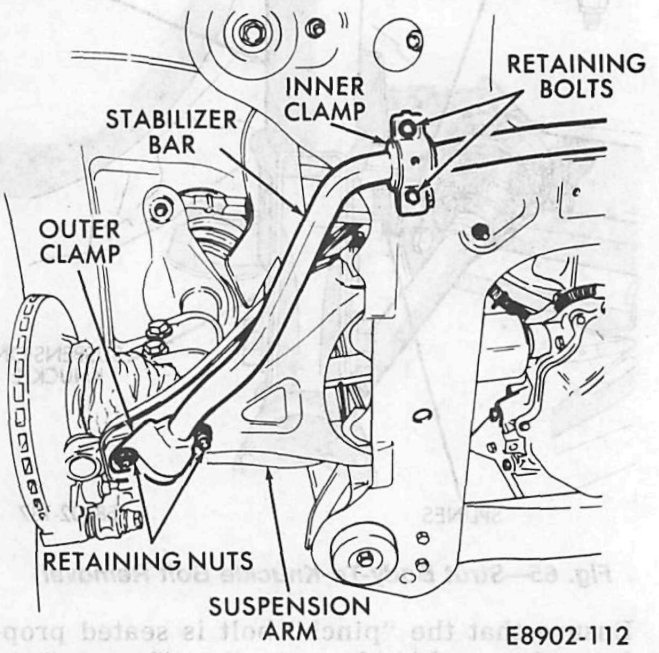


Fig. 69—Stabilizer Bar Retaining Nuts & Bolts

FRONT WHEEL ALIGNMENT

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ALIGNMENT INFORMATION

Wheel Caster and Camber Angles

The Eagle Premier front wheel caster and camber angles are permanently set during manufacture and are not adjustable. If the caster angle or the camber angle at either wheel is incorrect, the suspension or steering component that is causing the applicable angle(s) to be incorrect must be repaired (if possible) or replaced. If the cause of an incorrect caster and/or camber angle is not readily identifiable, refer to the Alignment Diagnosis chart for assistance in identifying the component(s) that is/are possibly causing the incorrect angle(s).

The cross-relationship between the left and the right wheel caster angles and, also, the left and the right wheel camber angles is critical. A wheel-to-wheel caster or camber angle variation of more than one degree can result in a strong "pull" on one side of the vehicle and/or rapid front tire tread wear.

Incorrect or excessive wheel-to-wheel caster and/or camber angle variation is not the only possible cause of vehicle "pull" or rapid front tire tread wear. Brake "drag", a damaged or under-inflated tire, body/chassis damage and damage to the steering system components can all cause vehicle "pull" and/or rapid front tire tread wear.

Wheel Toe Position

The front suspension for Premier vehicles is designed for wheel toe-out. The steering gear must be secured in the "centered" position before the wheel toe position is adjusted. The wheel toe adjustment is accomplished by loosening the tie rod adjustment sleeve locknuts and rotating the adjustment sleeve in the required direction until the correct wheel toe-out angle (or distance) is obtained. The wheel "turning" toe-out is not adjustable.

Although the wheel toe position does not usually affect vehicle driveability and steering, having the correct wheel toe position is very important to avoid rapid front tire tread wear. An excessive toe-out position will cause rapid tread wear from the inner edge of a front tire. An insufficient toe-out position (or a toe-in position) will cause rapid tread wear from the outer edge of a front tire.

Vehicle Front And Rear Height

The front and rear vehicle heights must be correct before accurate front wheel alignment angles can be obtained from measurement.

The vehicle rear height is adjusted by positioning the trailing suspension arms at the specified distance from the vehicle chassis and then rotating the front torsion bars from their original position to the position that will provide the correct vehicle rear height.

The vehicle front height is not adjustable and, if necessary, must be corrected by replacement/repair of damaged, worn or defective components.

The vehicle heights should be measured with the vehicle:

- unloaded,
- on a flat surface,
- fuel tank full of fuel, and
- tires all having the same recommended pressure.

Because of all the possible variations in vehicle tire height and in vehicle weight, four separate heights must be measured at each side of the vehicle to obtain the actual vehicle front and rear heights. Refer Suspension—Group 2 for detailed instructions involving vehicles height measurement and correction.

Tire Tread Wear

Rapid front tire tread wear can be caused by improper vehicle conditions (and driving habits) other than incorrect front wheel alignment angles. Some of the other conditions that contribute to rapid tire tread wear are:

- tire under-inflation,
- wheel/tire unbalance,
- brake "drag",
- worn/damaged front suspension components,
- out-of-round or bent wheels,
- defective tire casing, and
- excessive speed when turning a vehicle.

Alignment Diagnosis And Specifications

The Alignment Diagnosis and Alignment Specifications charts are provided (below) to assist in correcting front wheel alignment problems. The diagnosis chart provides a list of the common causes for incorrect caster, camber and toe angles. The specifications chart provides a list of all the angles for measurement reference.

CONDITION	POSSIBLE CAUSES
CASTER INCORRECT	BENT SUSPENSION ARM. BENT FRAME RAIL. BENT OR DAMAGED BODY/CHASSIS COMPONENTS. LOOSE OR WORN SUSPENSION ARM BUSHINGS.
CAMBER INCORRECT	BENT SUSPENSION ARM. BENT FRAME RAIL. BENT OR DAMAGED BODY/CHASSIS COMPONENTS. LOOSE OR WORN BALL JOINT. LOOSE OR WORN SUSPENSION ARM BUSHINGS.
TOE INCORRECT BY MORE THAN 6 MM (1/4 IN.) — (TOTAL TOE)	BENT OR DAMAGED SUSPENSION KNUCKLE. BENT TIE-ROD END. WORN OR LOOSE TIE-ROD END. WORN OR LOOSE SUSPENSION ARM BUSHINGS.

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ANGLE	SPECIFICATION	ADJUSTMENT	NOTES
TOE-OUT (PER WHEEL)	0° ±0.15° PER WHEEL (0 in. ±0.128 in.) (0 mm ±3.25 mm) WITH 620 mm DIAMETER WHEEL	ADJUSTABLE BY ROTATING THE TIE-ROD END ADJUSTMENT SLEEVES.	
CASTER	+2° TO ±0.5° (A) (B)	NON-ADJUSTABLE	(A) SIDE-TO-SIDE VARIATION NOT TO EXCEED 1°. (B) WITH STEERING GEAR CENTERED.
CAMBER	−0.08° TO −0.58° (A) (B)	NON-ADJUSTABLE	(A) SIDE-TO-SIDE VARIATION NOT TO EXCEED 1°. (B) WITH STEERING GEAR CENTERED.

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ALIGNMENT PROCEDURES

Alignment Procedures—Sequence

The following list provides the order that the alignment procedures should be accomplished:

- 1—complete the preliminary inspection;
- 2—center the steering gear;
- 3—measure the caster, camber and toe angles;
- 4—adjust to obtain the correct toe-out position; and
- 5—center the steering wheel.

The preliminary inspection should be completed before the vehicle is positioned on the alignment rack. Complete the remaining procedures while the vehicle is on the alignment rack.

Preliminary Inspection

Complete the following list of inspections and measurements before positioning the vehicle on the alignment rack.

(1) Verify that all of the tires are the same size and type.

(2) Examine the tire tread surfaces. Note the type and degree of tread wear (if any).

(3) Measure and adjust (if necessary) the tire inflation pressures.

(4) Measure the vehicle front and rear ride height. Refer Suspension—Group 2 for detailed instructions involving vehicle height measurement and correction. If incorrect, correct the vehicle height before proceeding to the alignment procedure.

(5) Examine the condition of the steering system and suspension components. Repair or replace any component that is worn or damaged before proceeding to the alignment procedure.

(6) Test the brakes for proper operation. Correct any malfunction (drag, grab, etc.) before proceeding to the alignment procedure.

(7) Inspect the front wheel bearings for looseness and excessive end-play. Refer to Tires And Wheels—Group 22 for additional front wheel bearing information. Correct any bearing malfunction before proceeding to the alignment procedure.

(8) Measure the wheel/tire radial and lateral "runout". Refer to Tires and Wheels—Group 22 for additional information. Correct any excessive "runout" before proceeding to the wheel alignment procedure.

The wheel/tire radial and lateral "runout" can be measured while on the alignment track when using certain computerized alignment equipment.

Steering Gear—Centering

See "STEERING" Group 19.

Caster, Camber And Toe Angles—Measurement

(1) Jounce the vehicle several times to seat all the suspension components.

(2) Measure the wheel angles in the following order:

- 1—caster,
- 2—camber, and then
- 3—toe.

(3) If the caster and/or camber angles are not within the specified limits (refer to the Alignment Specifications chart), the suspension, steering or body/chassis component(s) that is/are causing the misalignment must be repaired or replaced, as applicable. The Alignment Diagnosis chart provides a list of the common causes for incorrect caster and camber angles.

(4) If the toe position is not correct (refer to the Alignment Specifications chart), adjust the tie rods to obtain the correct angle. If necessary, refer to Toe Position—Adjustment below for detailed instructions. Center the steering wheel after the toe position adjustment is completed. Refer to Steering Wheel—Alignment below for detailed instructions.

(5) If the toe position is correct, (if necessary) center the steering wheel. Refer to Steering Wheel Alignment in "STEERING," Group 19 below for detailed instructions.

(6) Remove the vehicle from the alignment rack.

Toe Position—Adjustment

(1) Loosen the tie rod adjustment sleeve locknuts at each side of the vehicle. See STEERING, Group 19.

The outer locknut has right-hand threads and the inner locknut has left-hand threads.

(2) Turn each adjustment sleeve with a wrench in the direction necessary to obtain the required toe-out angle for each wheel.

(3) The number of exposed threads at each tie-rod end should be approximately the same.

(4) Retain the tie-rod adjustment sleeve in-place with a wrench and tighten the adjustment sleeve locknuts with 49 N·m (36 ft-lbs) torque.

(5) Remove the vehicle from the alignment rack.

Steering Wheel—Alignment

See "STEERING," Group 19.

DRIVESHAFT SERVICE

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SERVICE INFORMATION

Use care when involved with drive shafts during service operations. The rubber boots located at the ends of each shaft can be easily damaged by rough treatment.

When servicing components in the immediate area of either drive shaft, wrap the drive shaft rubber boot(s), as applicable, with heavy duty shop cloths or towels for protection. Do not allow the rubber boots to be damaged.

Do not strike the drive shaft ends or allow other components to fall on the shaft or the rubber boots. When the drive shaft is removed for service, do not allow it to fall to the surface or contact other objects. The drive shaft may appear to be normal but internal damage could have been caused by the rough treatment.

Inspect the drive shaft rubber boots before installing the shaft. Replace any boot that is damaged. Damaged boots will result in loss of CV joint lubricant and eventual excessive shaft component wear.

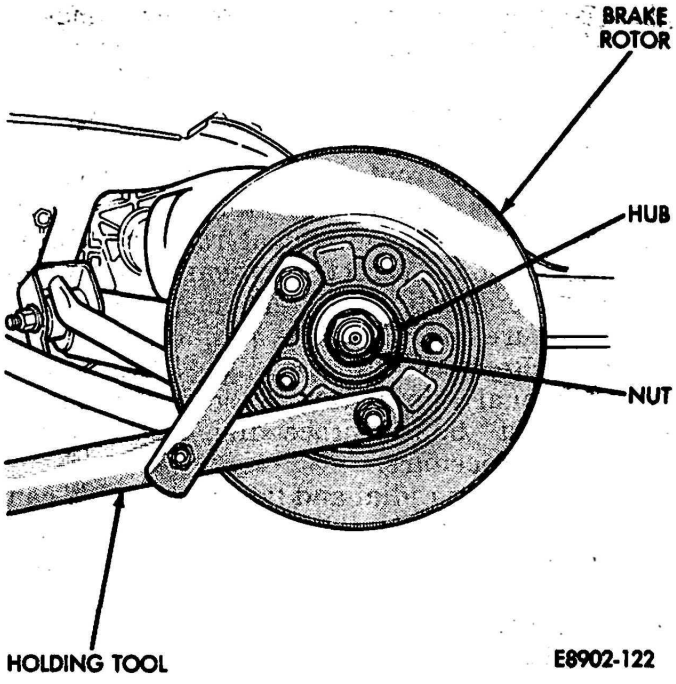


Fig. 70—Drive Shaft-To-Wheel Hub Nut Removal

REMOVAL/INSTALLATION

Removal

(1) Raise and support the front of the vehicle.

(2) Remove the wheel/tire.

CAUTION: Do not allow the brake hose to support the caliper weight. Attach the caliper to the vehicle chassis or body with twine or a wire hanger.

(3) Remove the brake caliper. Do not disconnect the brake hose from the caliper. If necessary, refer to the caliper removal procedure in Group 5 for detailed instructions.

(4) Remove the drive shaft-to-wheel hub nut. Use an appropriate holding tool to retain the wheel rotor/hub (Fig. 70) when removing the nut.

A single, spiral wound roll pin (Fig. 71) is used to retain each drive shaft at the transaxle.

(5) Remove the drive shaft-to-transaxle shaft roll pin with an appropriate size drift tool (Fig. 72).

CAUTION: Before proceeding to the next step, ensure that the front suspension is "hanging free". There must not be any pressure or tension on any of the front suspension components.

The strut body-to-suspension knuckle bolts are "splined". Remove the bolts only as instructed in the procedure below.

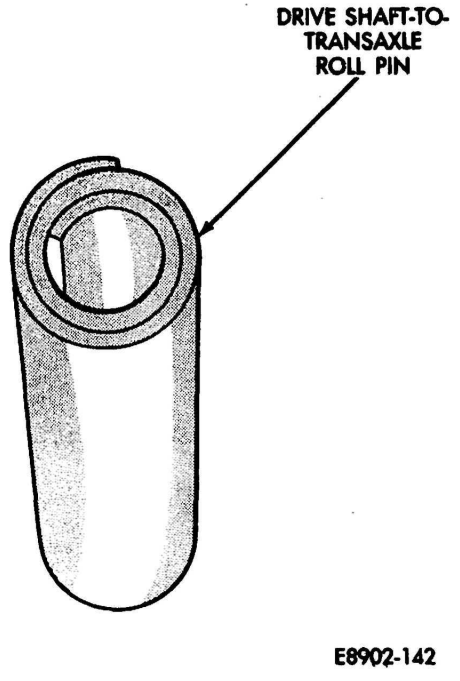


Fig. 71—Roll Pin

(6) Remove the two "splined" bolts that attach the strut body to the suspension knuckle (Fig. 73) according to the following instructions:
- loosen the nuts,
- turn the nuts until they are almost at the end of the bolt threads,
- "tap" the nuts with a brass hammer to loosen the bolts and disengage the splines (Fig. 74), and
- remove the nuts and slide the bolts out of the strut body and the suspension knuckle.

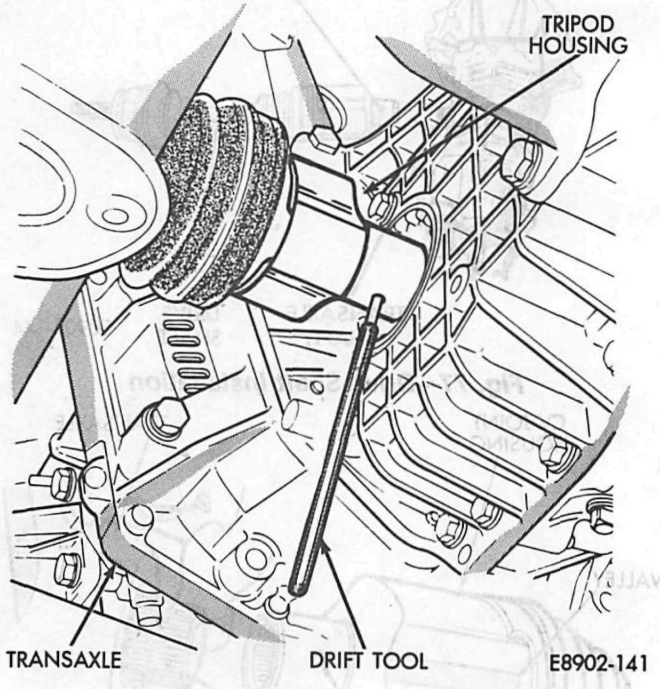


Fig. 72—Roll Pin Removal

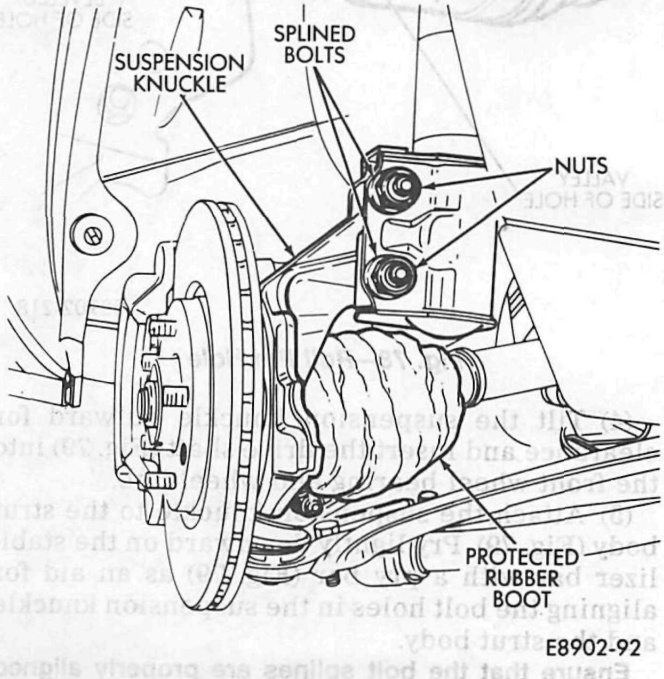


Fig. 73—Strut Body-To-Suspension Knuckle Bolts

(7) Place a drain pan under the transaxle end of the drive shaft.

(8) For protection, wrap the drive shaft outer rubber boot (Fig. 75) with a heavy duty shop cloth or towel to prevent damage to the boot.

(9) Tilt the suspension knuckle out and away from the strut body and remove the drive shaft (Fig. 75).

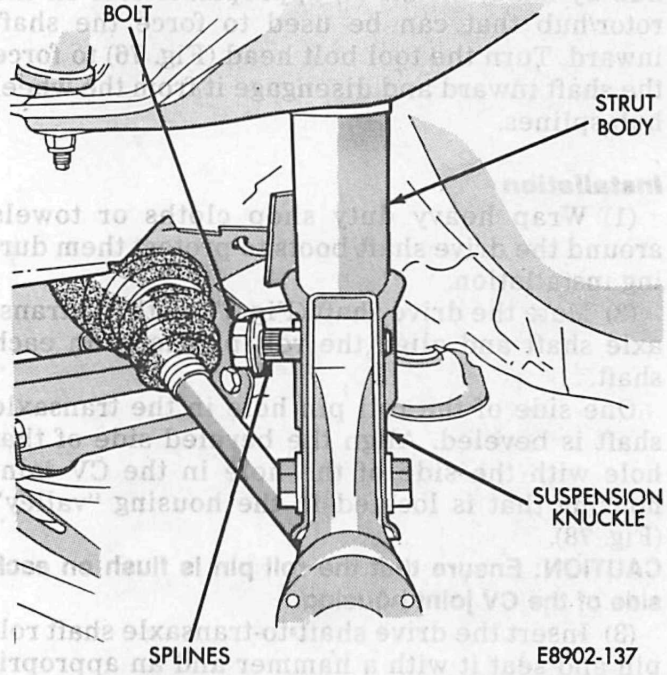


Fig. 74—"Splined" Bolt Removal

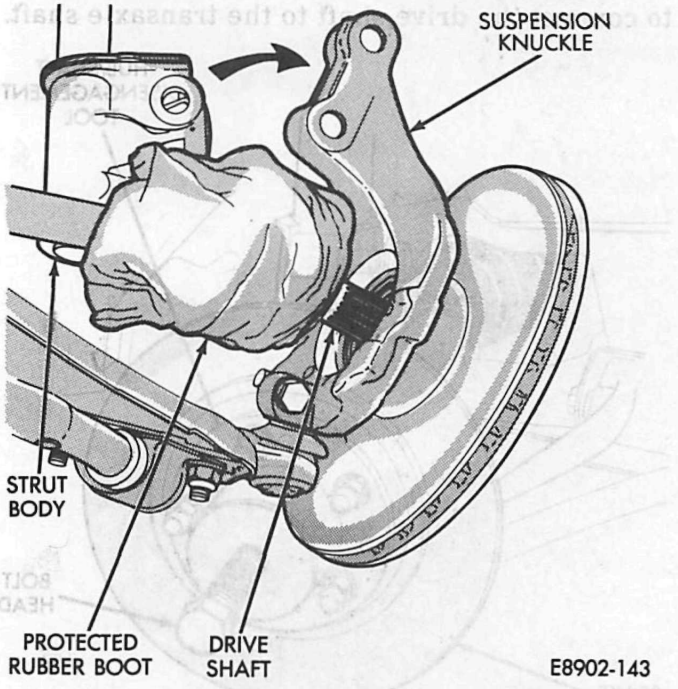


Fig. 75—Drive Shaft Removal

CAUTION: Do not strike the end of the drive shaft with a hammer or other hard object to loosen or disengage it from the wheel hub. The very likely result will be damage to the shaft threads and/or the CV joints.

(10) Force the drive shaft inward to disengage the shaft splines from the wheel hub splines. If the shaft cannot be disengaged from the wheel hub by hand, install an appropriate tool on the rotor/hub that can be used to force the shaft inward. Turn the tool bolt head (Fig. 76) to force the shaft inward and disengage it from the wheel hub splines.

Installation

(1) Wrap heavy duty shop cloths or towels around the drive shaft boots to protect them during installation.

(2) Mate the drive shaft (Fig. 77) with the transaxle shaft and align the roll pin holes in each shaft.

One side of the roll pin hole in the transaxle shaft is beveled. Align the beveled side of that hole with the side of the hole in the CV joint housing that is located in the housing "valley" (Fig. 78).

CAUTION: Ensure that the roll pin is flush on each side of the CV joint housing.

(3) Insert the drive shaft-to-transaxle shaft roll pin and seat it with a hammer and an appropriate size drift tool.

A single, spiral-wound roll pin (Fig. 71) is used to connect the drive shaft to the transaxle shaft.

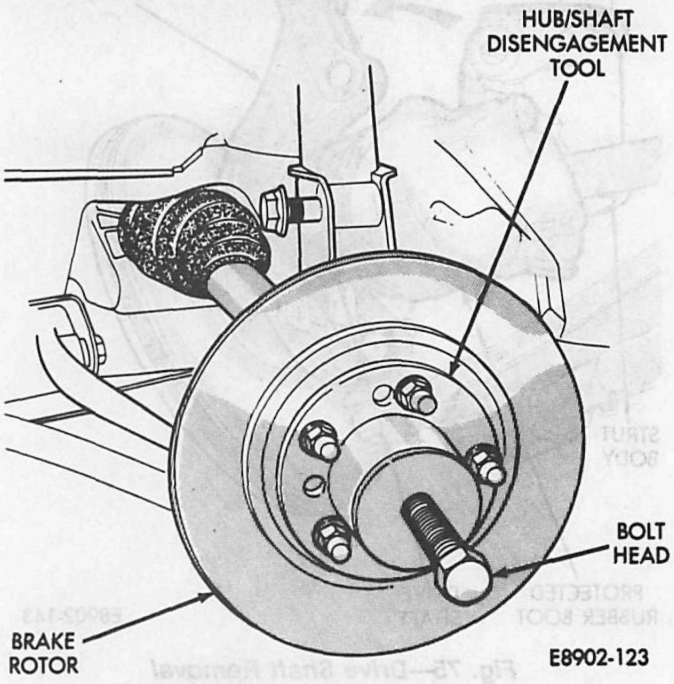


Fig. 76—Wheel Hub & Drive Shaft Disengagement

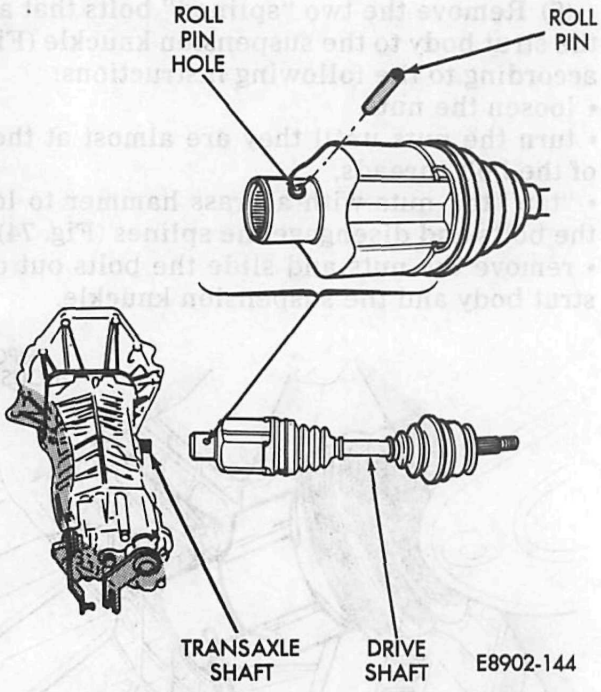


Fig. 77—Drive Shaft Installation

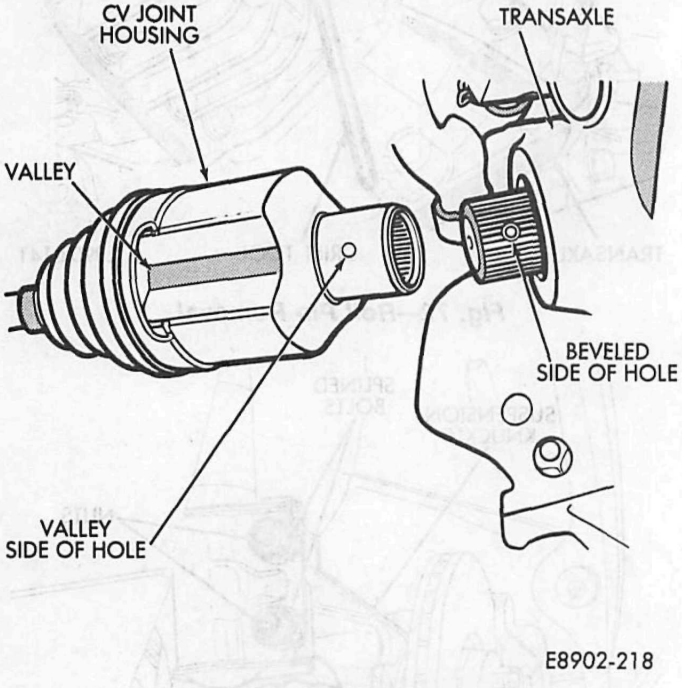


Fig. 78—Roll Pin Hole

(4) Tilt the suspension knuckle outward for clearance and insert the drive shaft (Fig. 79) into the front wheel bearing and wheel hub.

(5) Attach the suspension knuckle to the strut body (Fig. 79). Pry lightly downward on the stabilizer bar with a pry bar (Fig. 79) as an aid for aligning the bolt holes in the suspension knuckle and the strut body.

Ensure that the bolt splines are properly aligned in the strut body holes before "tapping" the bolts

into position and installing the nuts. Retain each bolt head in place with a wrench when tightening the nut. CAUTION: Tighten with a wrench turning the strut body retaining nuts only. DO NOT attempt to turn the bolts because they are "splined".

(6) Install the strut body-to-suspension knuckle bolts and nuts. Tighten the nuts (Fig. 73) with 167 N·m (123 ft-lbs) torque.

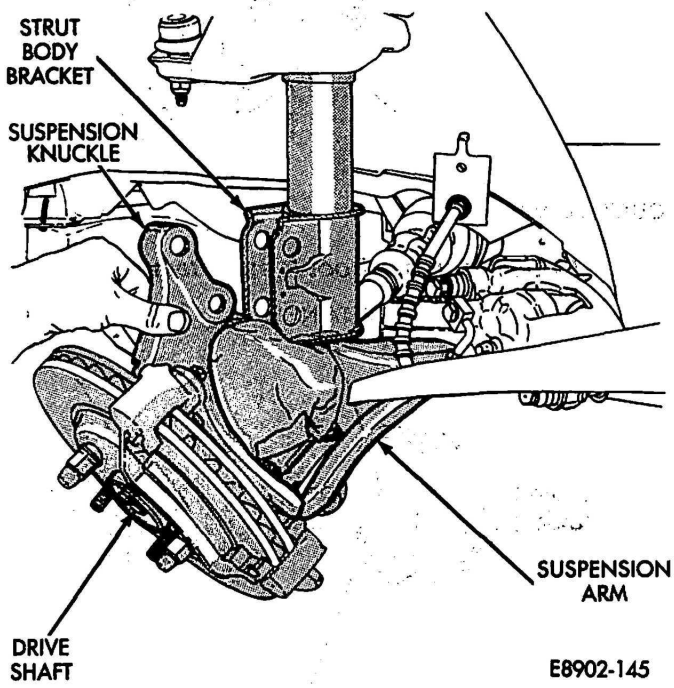


Fig. 79—Suspension Knuckle-To-Strut Installation

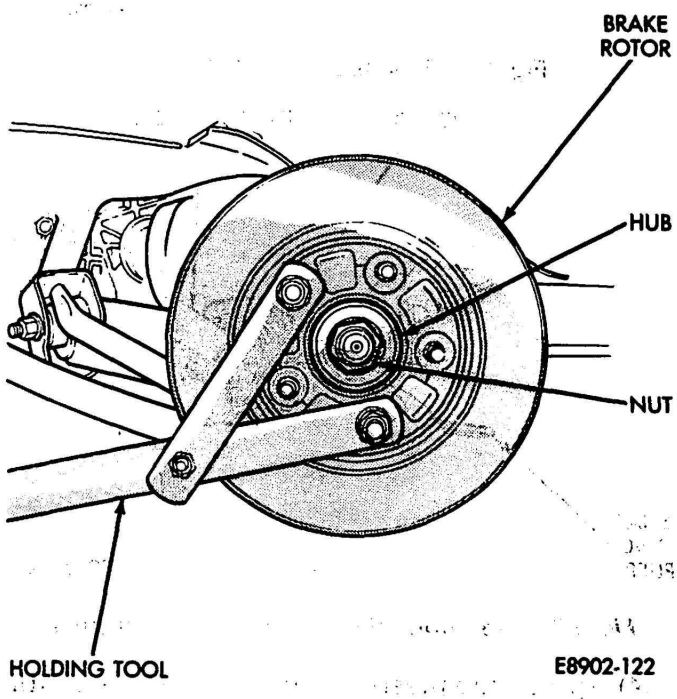


Fig. 80—Drive Shaft-To-Wheel Hub Nut Installation

CAUTION: Do not use an impact wrench to tighten the drive shaft-to-wheel hub nut, use a torque wrench only to tighten the nut. It is also essential that the drive shaft-to-wheel hub nut be tightened with the specified tightening torque. In addition to retaining the wheel hub on the drive shaft, the specified torque also establishes the wheel bearing "preload".

(7) Install the drive shaft-to-wheel hub nut. Use an appropriate holding tool to retain the brake rotor and wheel hub in place (Fig. 80) while tightening the nut with 245 N·m (181 ft-lbs) torque.

(8) Install the brake caliper. If necessary, refer to the brake caliper installation procedure in Group 5 for detailed instructions.

(9) If equipped with a manual transaxle, check and adjust transaxle lubricant level (if necessary).

(10) Remove the shop cloths or towels from around the drive shaft boots and install the wheel/tire. Tighten the lug nuts with 85 N· (63 ft-lbs) torque.

(11) Remove the support and lower the vehicle.

(12) If equipped with an automatic transaxle, check and adjust transaxle fluid level (if necessary).

(13) Depress the brake pedal several times to seat the brake pads before moving the vehicle.

REPAIR

Service Information

The drive shaft (Fig. 81) is comprised of:

- an inner "tripod" CV joint,
- an interconnecting shaft, and
- an outer "Rzeppa" CV joint with a stub shaft.

The inner (tripod) CV joint (Fig. 82) can be disassembled but must be replaced as a unit. The outer (Rzeppa) CV joint (Fig. 83) cannot be disassembled and must also be replaced as a unit.

The protective rubber boots (and clamps) that cover each CV joint are replaceable components.

The applicable CV joint must be removed from the interconnecting shaft to replace a rubber boot.

Outer CV Joint

Removal

(1) Remove the drive shaft. If necessary, refer to the removal procedure in this section of Group 2 for detailed instructions.

(2) Cut and remove the boot clamps (Fig. 84).

CAUTION: If the rubber boot is reusable, use care when cutting the clamps. Do not accidentally cut the boot when cutting the clamps.

(3) Slide the rubber boot (Fig. 85) off the CV joint housing for access to the plastic retainer.

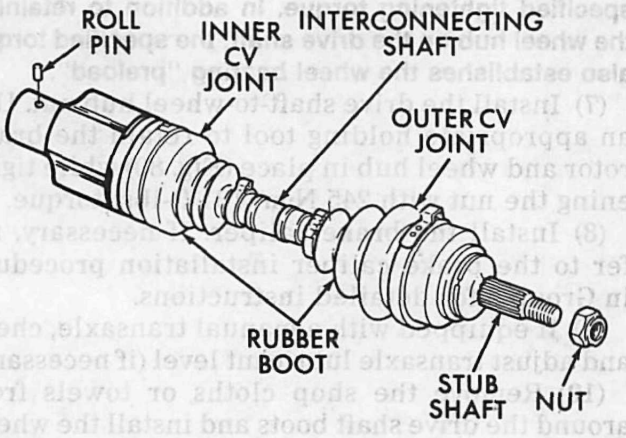


Fig. 81—Drive Shaft

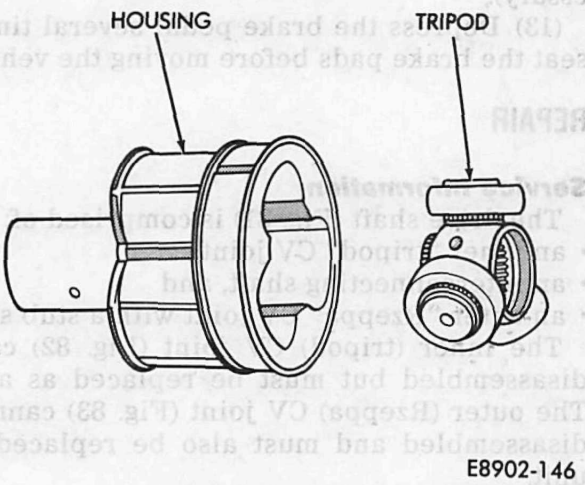


Fig. 82—Inner CV Joint

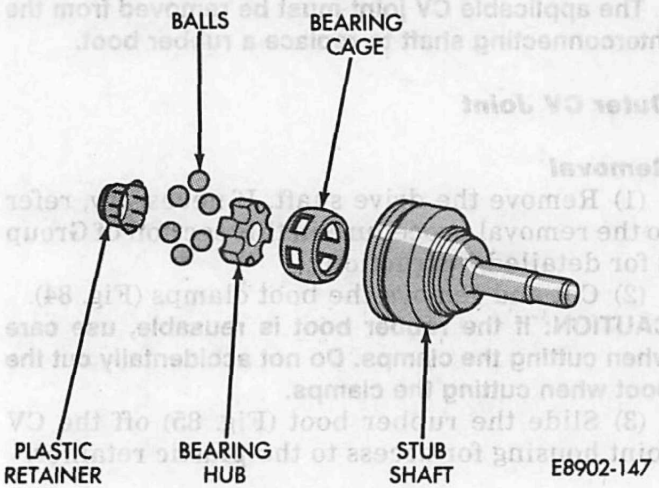


Fig. 83—Outer CV Joint

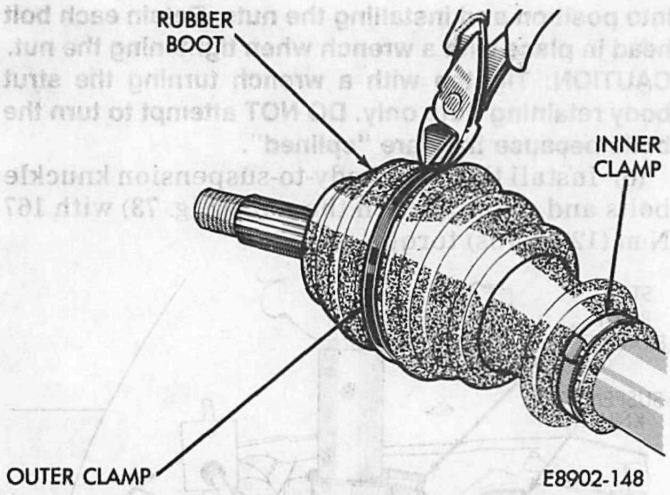


Fig. 84—Rubber Boot Clamp Removal

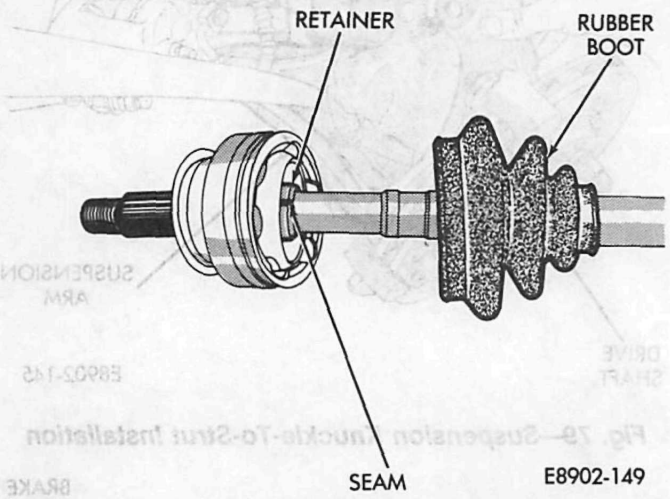


Fig. 85—Exposed Outer CV Joint

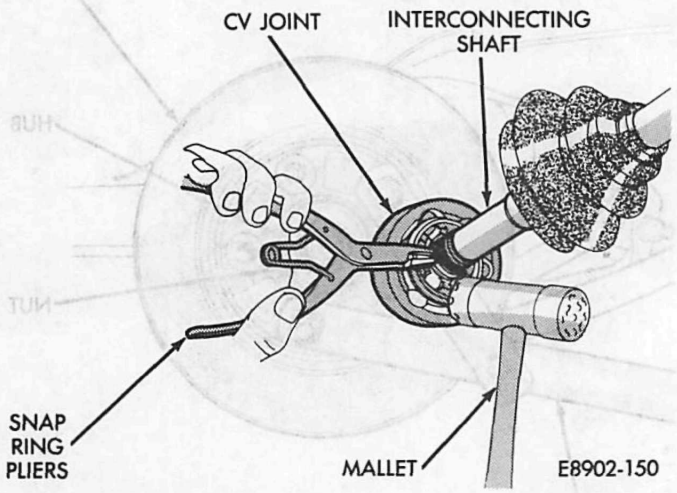


Fig. 86—Interconnecting Shaft Disengagement

(4) Spread the plastic retainer at the seam with snap ring pliers (Fig. 86).

(5) "Tap" the outer CV joint with a plastic mallet to disengage the interconnecting shaft from the retainer (Fig. 86).

(6) Separate the outer CV joint from the interconnecting shaft (Fig. 87).

(7) Slide the rubber boot off the end of the interconnecting shaft (Fig. 88). Inspect the rubber boot for damage. If damaged, replace the boot.

Installation

(1) Inspect the plastic retainer in the outer CV joint. Replace the retainer if it is damaged or defective (Fig. 89).

If a replacement retainer must be installed, ensure that it is installed correctly (Fig. 89). The tapered end mates with the interconnecting shaft and the segmented end mates with the CV joint.

(2) Install the rubber boot (Fig. 88) on the interconnecting shaft.

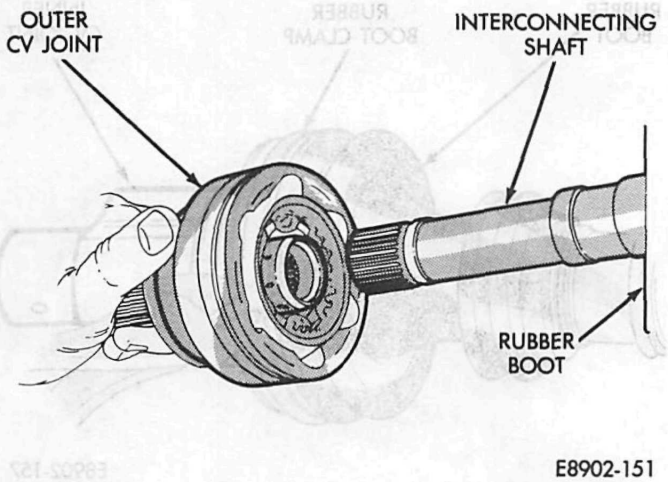


Fig. 87—Outer CV Joint Removal

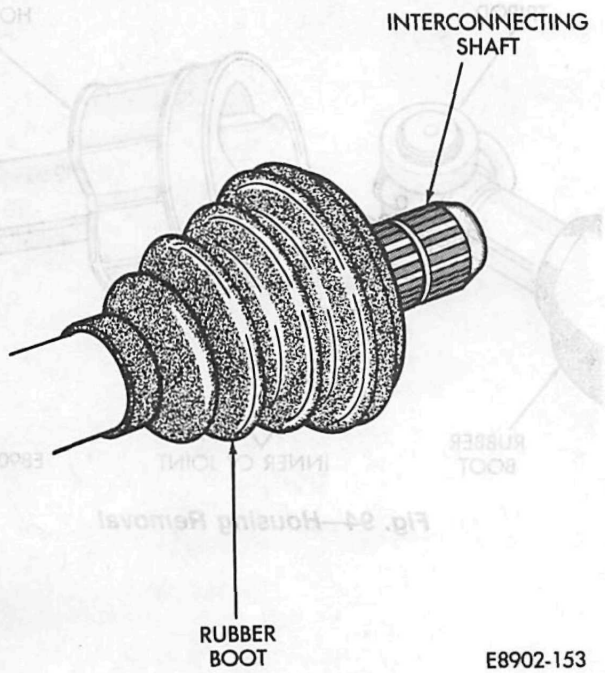


Fig. 88—Rubber Boot Removal/Installation

(3) Thoroughly lubricate the CV joint and the interior of the rubber boot with the lubricant supplied with the service kit. Use all of the lubricant supplied with the service kit.

(4) Align the interconnecting shaft with the plastic retainer and the CV joint (Fig. 90). When aligned, "tap" the CV joint onto the shaft with a plastic mallet. Continue "tapping" the CV joint until the segmented end on the retainer "snaps" into position on the shaft.

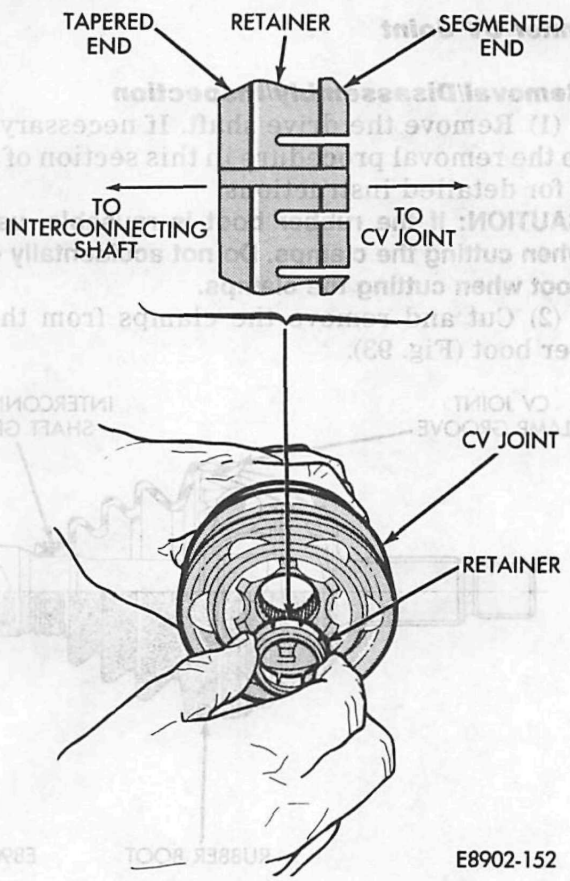


Fig. 89—Plastic Retainer Installation

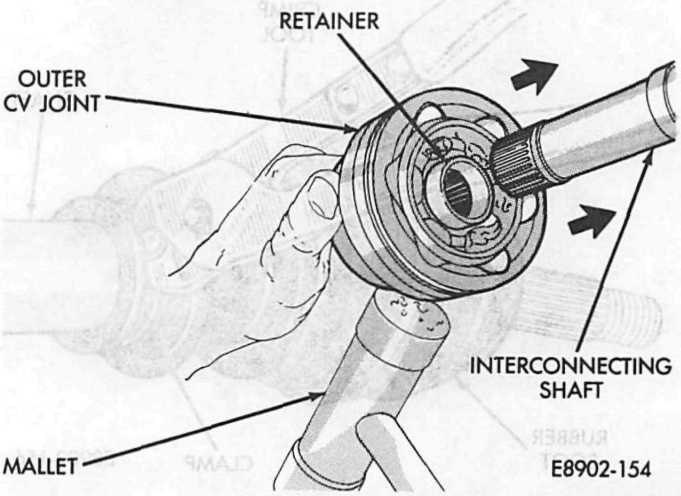


Fig. 90—CV Joint Installation

(5) Position the rubber boot on the clamp grooves machined in the CV joint and in the interconnecting shaft (Fig. 91).

(6) Attach the rubber boot to the interconnecting shaft and to the CV joint with replacement clamps. Tighten (crimp) the clamps with an appropriate clamp crimping tool (Fig. 92).

(7) Install the drive shaft on the vehicle. If necessary refer to the installation procedure in this section of Group 2 for detailed instructions.

Inner CV Joint

Removal/Disassembly/Inspection

(1) Remove the drive shaft. If necessary, refer to the removal procedure in this section of Group 2 for detailed instructions.

CAUTION: If the rubber boot is reusable, use care when cutting the clamps. Do not accidentally cut the boot when cutting the clamps.

(2) Cut and remove the clamps from the rubber boot (Fig. 93).

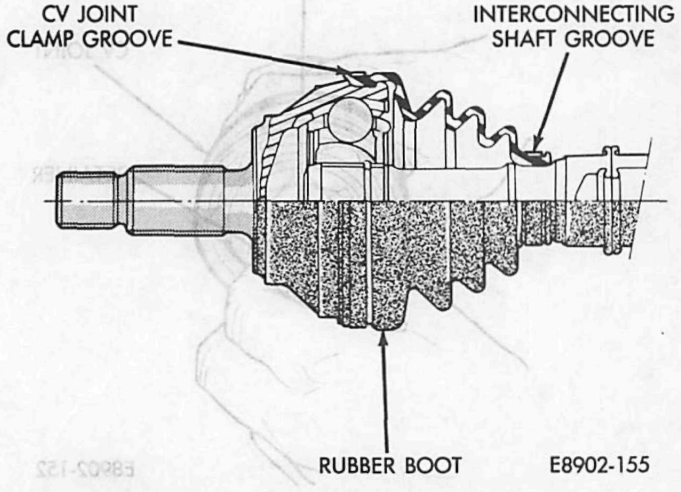


Fig. 91—Rubber Boot Installation

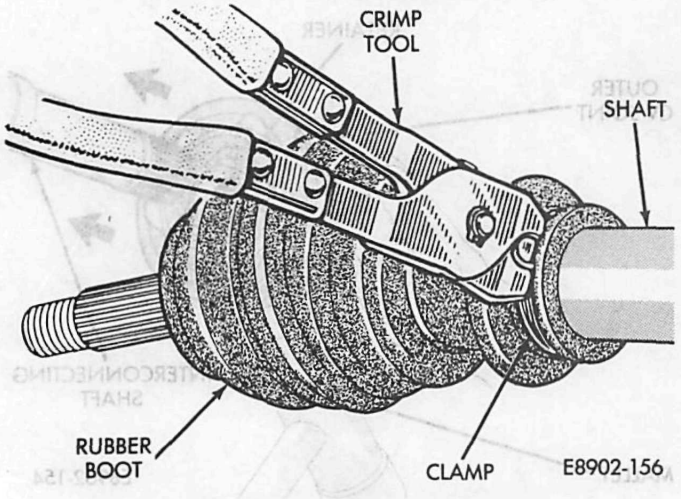


Fig. 92—Rubber Boot Clamp Installation

(3) Remove the rubber boot from the inner CV joint housing.

(4) Remove the inner CV joint housing (Fig. 94) by pulling it straight away from the tripod.

(5) Spread the plastic retainer with snap ring pliers and "tap" the tripod (Fig. 95) with a plastic mallet to remove it from the interconnecting shaft.

If necessary, cut the retainer to remove it.

(6) Slide the rubber boot off the interconnecting shaft.

(7) Inspect the rubber boot, the CV joint housing, the plastic retainer and the tripod/bearings. Replace the rubber boot if it is damaged and is not reusable. Replace the complete CV joint if any of its components are worn, damaged or defective.

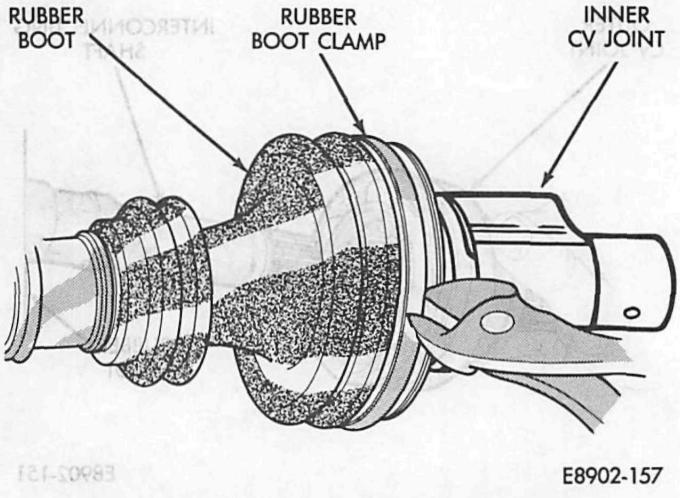


Fig. 93—Rubber Boot Clamp Removal

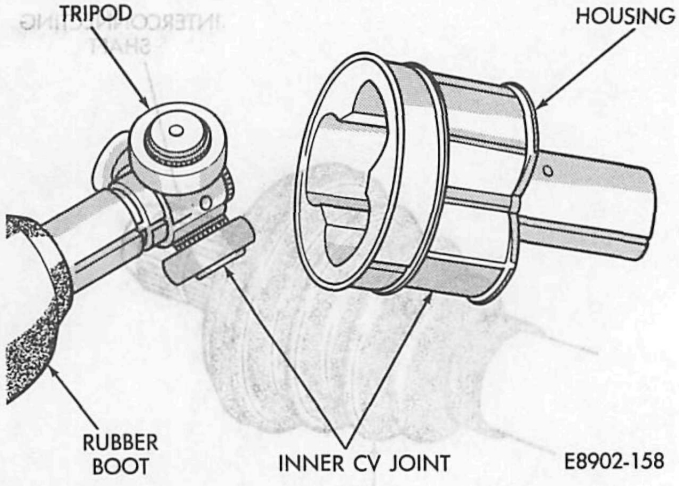


Fig. 94—Housing Removal

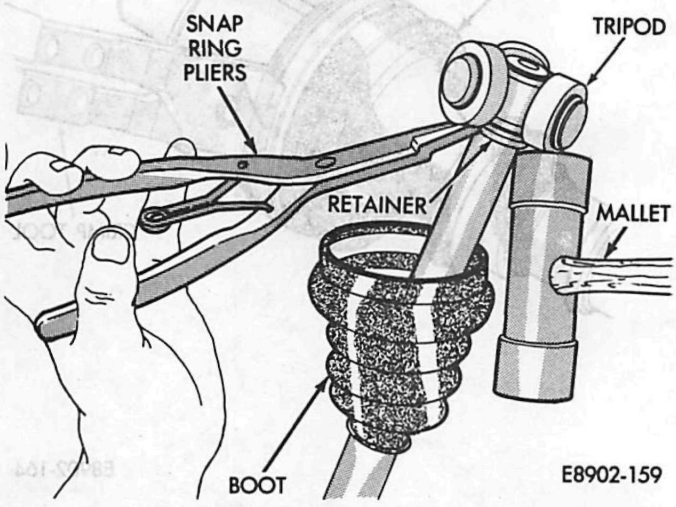


Fig. 95—Tripod Removal

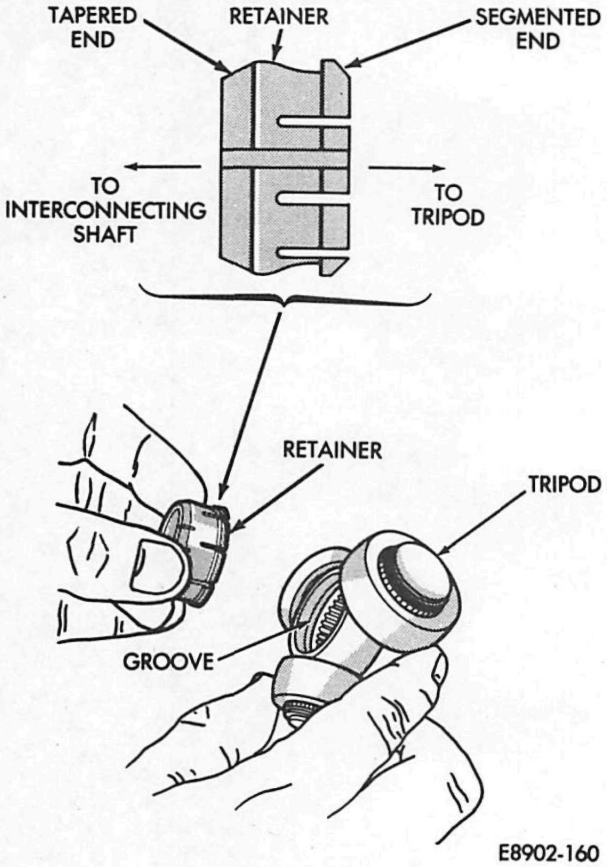


Fig. 96—Plastic Retainer Installation

Installation

If a replacement retainer (Fig. 96) must be installed, ensure that it is installed correctly. The segmented end mates with the tripod and the tapered end mates with the interconnecting shaft.

(1) Install the plastic retainer in the tripod (Fig. 96). Insert and force the segmented end of the retainer into the tripod until it "snaps" into the groove.

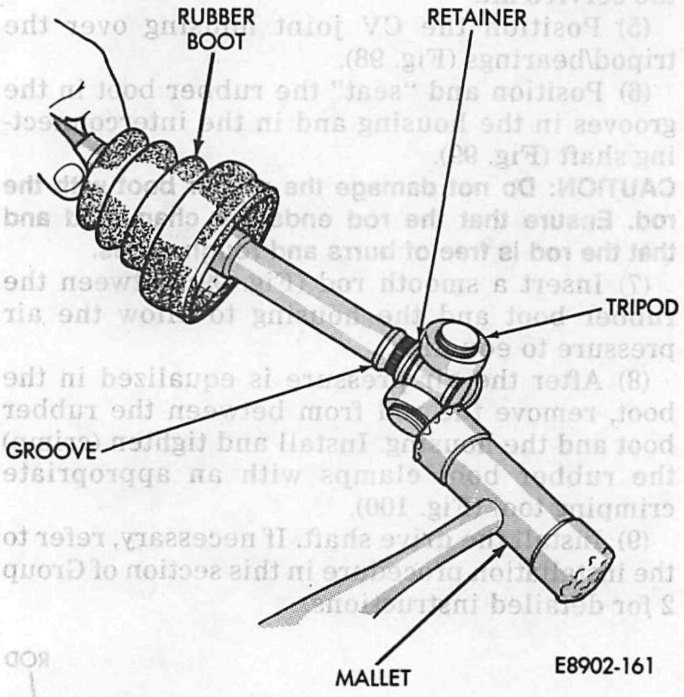


Fig. 97—Tripod Installation

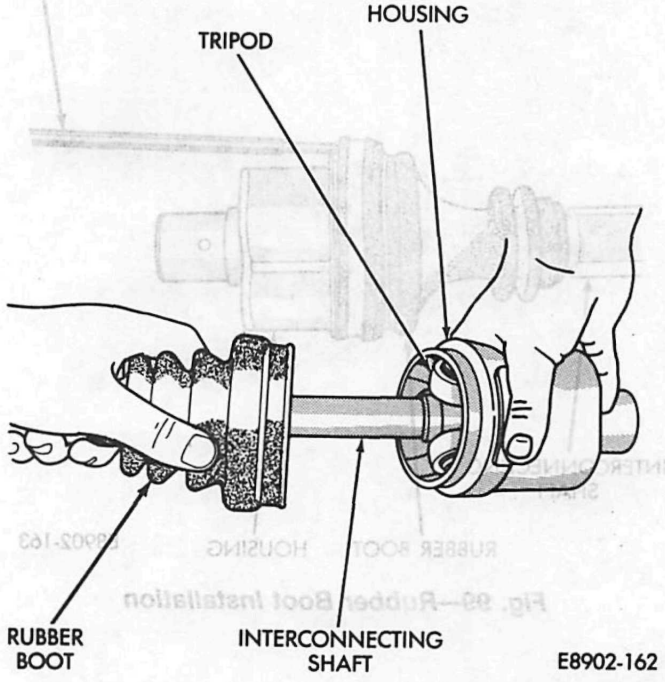


Fig. 98—Housing Installation

(2) Install the rubber boot on the interconnecting shaft (Fig. 97).

(3) Align the tripod with the interconnecting shaft and "tap" it with a plastic mallet until the retainer "seats" in the shaft groove (Fig. 97).

(4) Thoroughly lubricate the CV joint housing, tripod/bearings and the interior of the rubber boot with the lubricant supplied with the service kit. Use all of the lubricant supplied with the service kit.

(5) Position the CV joint housing over the tripod/bearings (Fig. 98).

(6) Position and "seat" the rubber boot in the grooves in the housing and in the interconnecting shaft (Fig. 99).

CAUTION: Do not damage the rubber boot with the rod. Ensure that the rod ends are chamfered and that the rod is free of burrs and rough edges.

(7) Insert a smooth rod (Fig. 99) between the rubber boot and the housing to allow the air pressure to equalize.

(8) After the air pressure is equalized in the boot, remove the rod from between the rubber boot and the housing. Install and tighten (crimp) the rubber boot clamps with an appropriate crimping tool (Fig. 100).

(9) Install the drive shaft. If necessary, refer to the installation procedure in this section of Group 2 for detailed instructions.

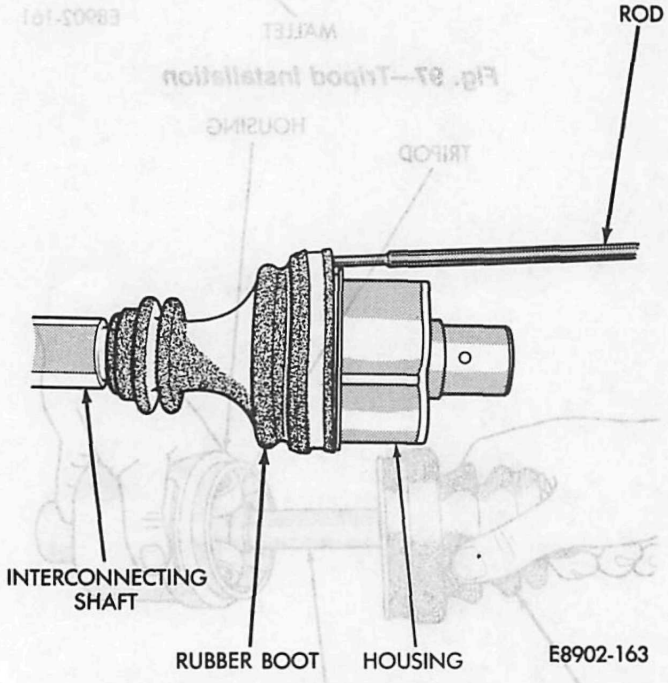


Fig. 99—Rubber Boot Installation

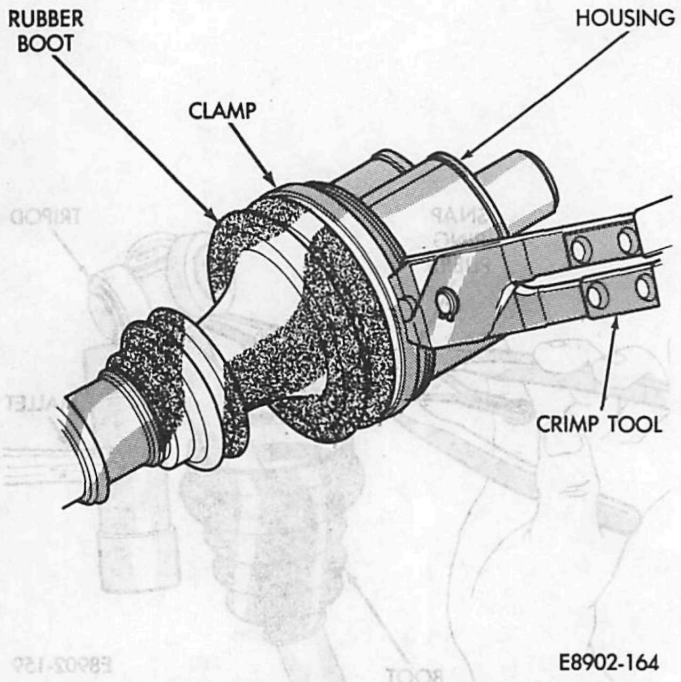


Fig. 100—Rubber Boot Clamp Installation

REAR SUSPENSION SERVICE

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CAUTION: NEVER raise an Eagle Premier vehicle with a "lift" positioned under the V-shaped rear crossmember. Refer to the vehicle lifting procedures in Group 0 for detailed lifting instructions.

SHOCK ABSORBERS

Service Information

Eagle Premier vehicles are equipped with mono-tube, gas charged (high-pressure) rear shock absorbers (Fig. 101).

Removal

(1) Raise and support the rear of the vehicle.

(2) Lift upward at the trailing arm (Fig. 102) to relieve the weight from the shock absorber.

(3) Remove the bolts (Fig. 102) that attach the top of the shock absorber to the vehicle chassis and the bottom of the shock absorber to the trailing arm. Remove the shock absorber.

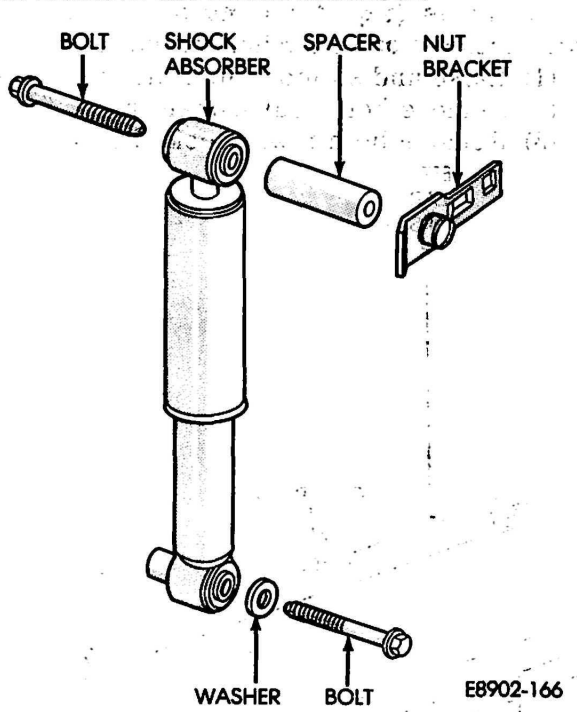


Fig. 101—Rear Shock Absorber

Installation

(1) Position the shock absorber on the vehicle and install the attaching bolts through the eyelets.

(2) Tighten the upper bolt (Fig. 102) with 82 N·m (60 ft-lbs) torque.

(3) Tighten the lower bolt (Fig. 102) with 115 N·m (85 ft-lbs) torque.

(4) Remove the supports and lower the vehicle.

TORSION BARS

Service Information

Eagle Premier vehicles are equipped with four interconnecting torsion bars. The torsion bars function as rear springs and stabilizer bar.

Left- And Right-Hand Bar Identification

Because the torque (developed from the vehicle load that the torsion bars support) is exerted at different angles and causes the bars at each side of the vehicle to "twist" in opposite directions, the right-hand and left-hand bars are machined differently. Ensure that the applicable torsion bars are installed on the correct side of the vehicle. A left-hand bar is identified by the

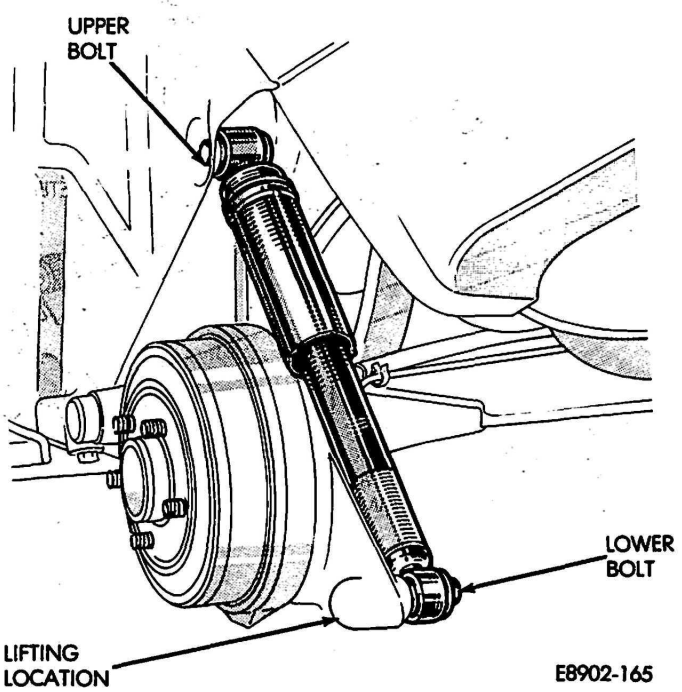


Fig. 102—Shock Absorber Removal/Installation

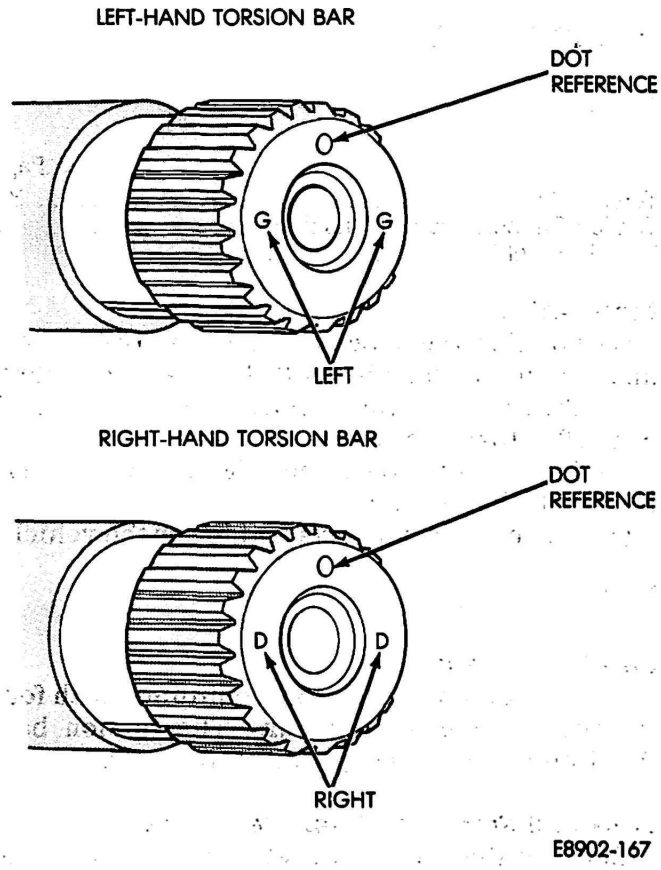


Fig. 103—Torsion Bar Identification

letter "G" stamped into each side of the outer end of the bar. A right-hand bar is identified by the letter "D" stamped into each side of the outer end of the bar (Fig. 103).

In addition, the outer end of each torsion bar has 31 splines and the inner end of each torsion bar has 30 splines. The torsion bars have a "DOT" stamped into their outer ends (Fig. 103) to assist in end-identification and installation reference.

The "DOT" stamped end of the torsion bars must always be installed facing toward the outside of the vehicle.

Length And Diameter Differences

The front and the rear torsion bars different in length (Fig. 104); the front torsion bars are 667 mm (26.25 in) in length and the rear torsion bars are 591 mm (23.26 in) in length.

Also, the rear tension bars that a particular vehicle is equipped with will depend on the suspension package installed on the vehicle. Each rear torsion bar is "color-coded" to identify its diameter. Refer to the illustration (Fig. 104) for an explanation of the color code.

Removal

CAUTION: NEVER raise an Eagle Premier vehicle with a "lift" positioned under the V-shaped rear crossmember. Refer to the vehicle lifting procedure in Group 0 for detailed lifting instructions. A hydraulic jack (or other supporting device) may be placed under the crossmember (Fig. 105) only to support its weight and the weight the other rear suspension components (e.g., for removal/installation of the crossmember or for torsion bar replacement).

(1) Raise and support the rear of the vehicle.
(2) Remove both rear wheel/tires.
(3) Remove both rear shock absorbers. If nec-

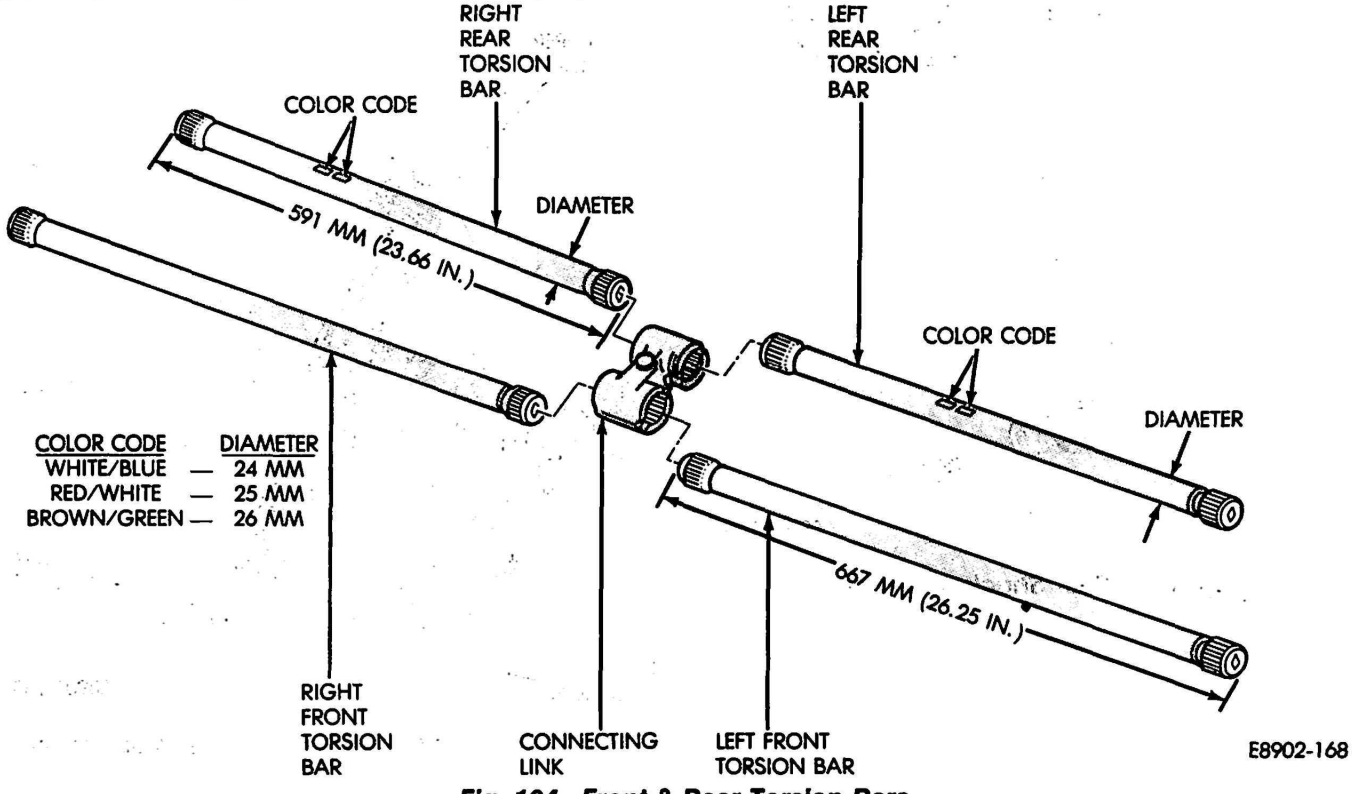


Fig. 104—Front & Rear Torsion Bars

essary, refer to the removal procedure in this section of Group 2 for detailed instructions.

Both rear shock absorbers must be removed even if only a left or right-hand torsion bar is being removed.

(4) Pry the protective-end caps (Fig. 106) loose and remove them from both front torsion bars.

(5) Un-thread the protective-end caps (Fig. 106) and remove them from both rear torsion bars.

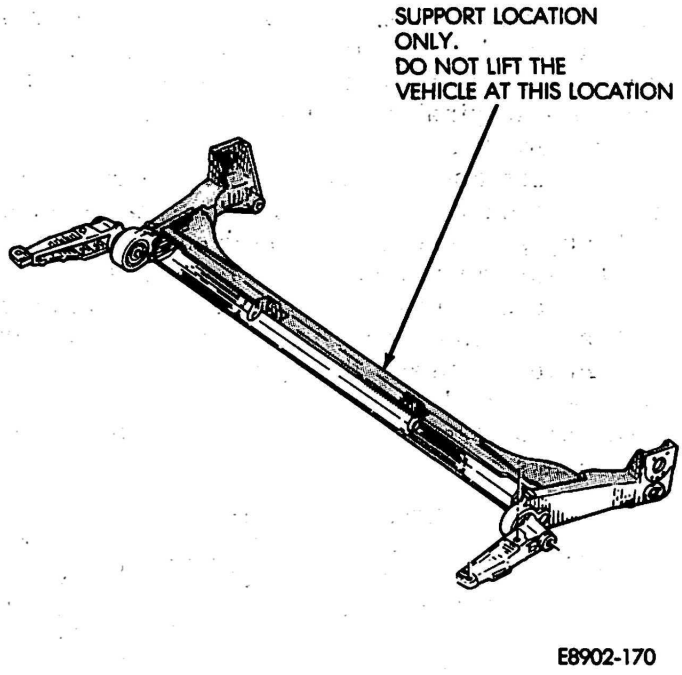


Fig. 105—Supported Crossmember

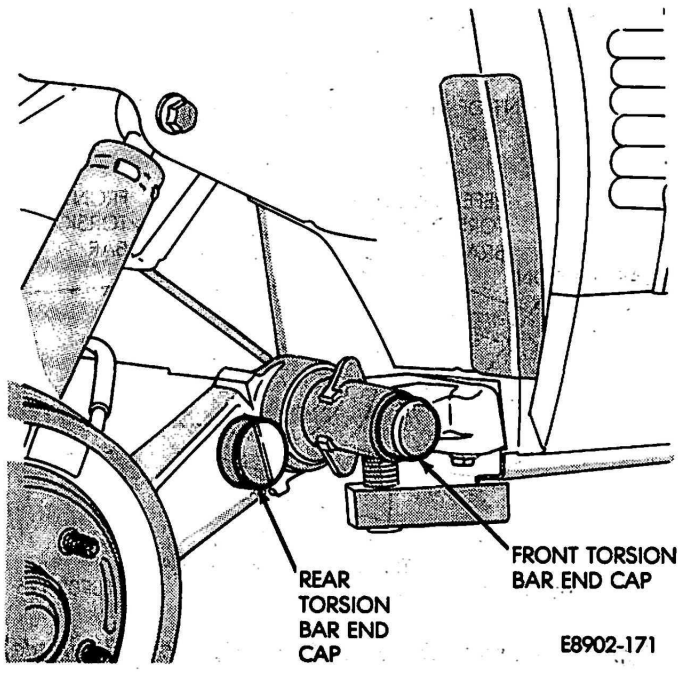


Fig. 106—Torsion Bar End Caps

(6) Pry the retaining clips (Fig. 107) away from the ends of the torsion bars and remove them.

Each torsion support bracket has an existing "DOT" stamped into it (Fig. 108) that provides a reference for the initial installation position of the front torsion bar. An additional installation position mark (Fig. 108) must be "punched" into the trailing suspension arm BEFORE the rear torsion bar is removed from the crossmember.

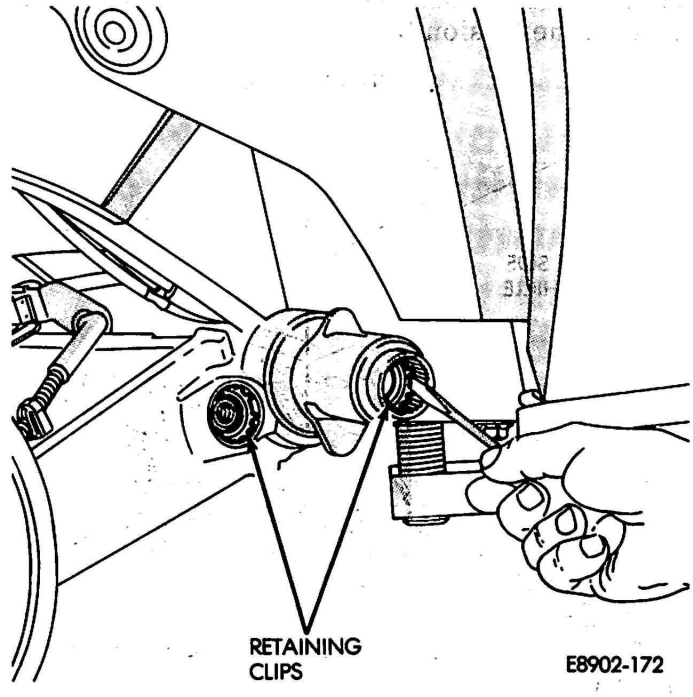


Fig. 107—Retaining Clip Removal

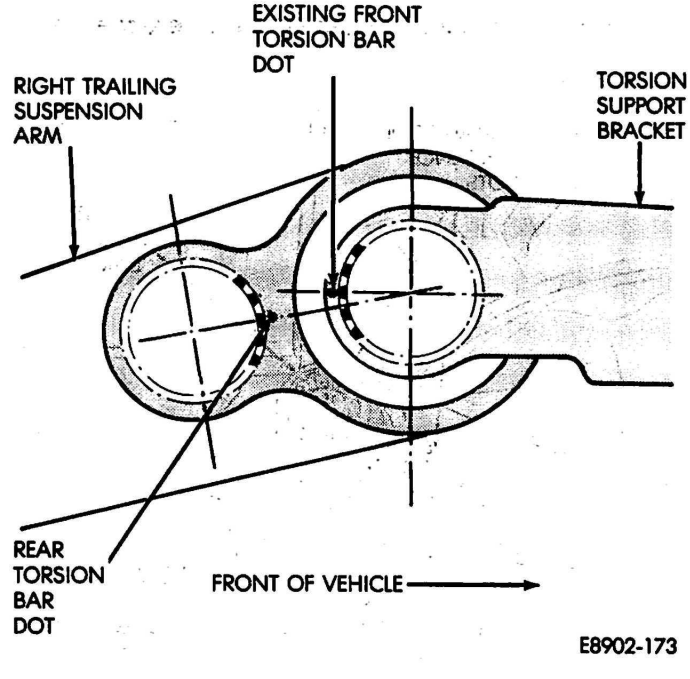


Fig. 108—Torsion Bar Installation Reference Dots

(7) Place a straightedge (or ruler) on the centerline of the two torsion bar installation holes and "punch" a "DOT" into the trailing suspension arm adjacent to a rear torsion bar spline groove (Fig. 108, Fig. 109).

(8) Note and record the relative positions of the installation reference "DOTS" on the ends of the torsion bars in respect to the "DOTS" on the torsion support bracket and the trailing suspension arm (Fig. 108, Fig. 109, Fig. 110) before removing the torsion bars.

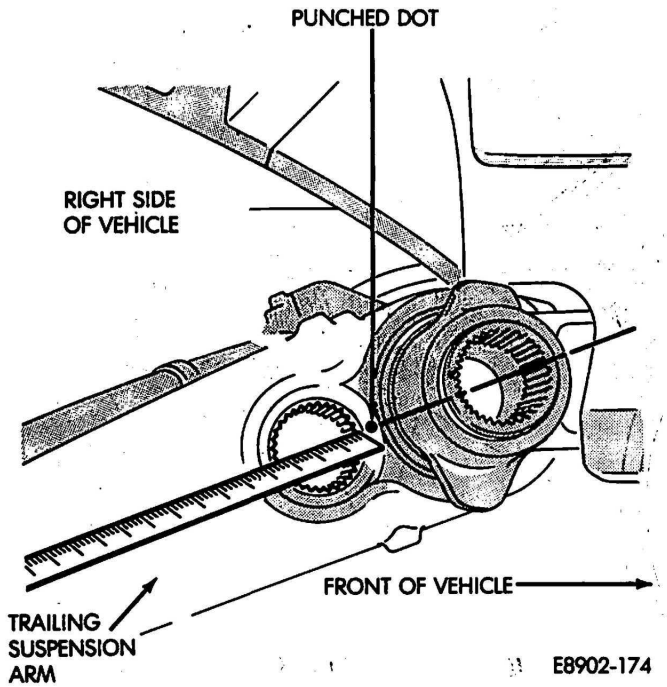


Fig. 109—"Punched" Installation Reference Dot

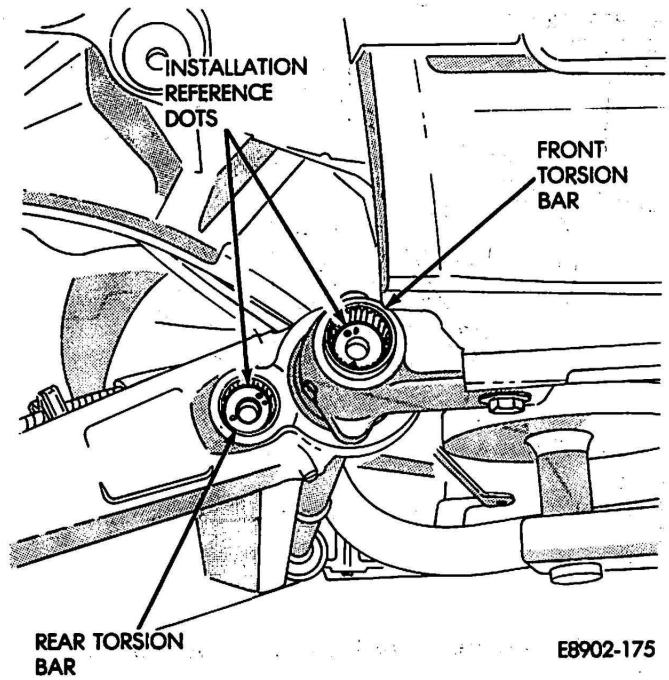


Fig. 110—Installation Reference Dots

Because of the different suspension packages available for Premier vehicles, the reference "DOTS" stamped into the ends of the torsion bars will be located at various positions in relatoin to the reference "DOTS" in the trailing suspension arms and the torsion brackets.

Example: For a particular vehicle, the "DOTS" stamped into the ends of the rear torsion bars (Fig. 111) are located five splines from the reference "DOTS" that were "punched" into the trailing suspension arms. The "DOTS" stamped into the ends of the front torsion bars (Fig. 111) are located one spline from the reference "DOTS" that were originally "stamped" into the torsion support brackets.

(9) Loosen and extract front torsion bars with a slide hammer (Fig. 112) sufficiently far enough to disengage the splines from the connecting link and the torsion support brackets (Fig. 113).

(10) Loosen and extract the rear torsion bars with a slide hammer (Fig. 114) sufficiently far enough to disengage the splines from the connecting link and the trailing suspension arms.

The rear crossmember must be lowered before the torsion bars can be removed from it.

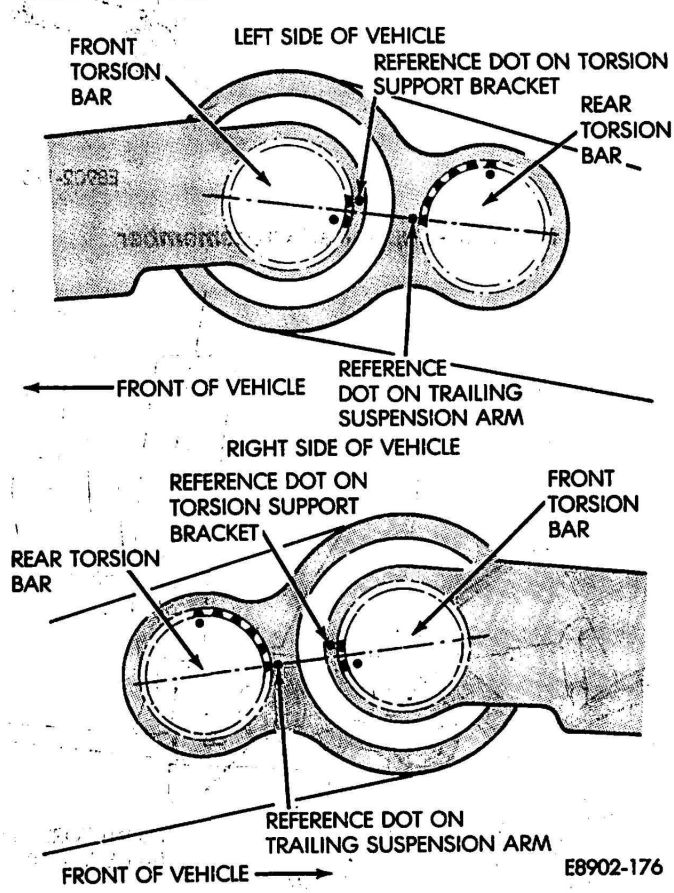


Fig. 111—Torsion Bar Installation Positions (Example)

CAUTION: DO NOT apply a lifting force to the hydraulic jack positioned under the rear crossmember, otherwise damage will result.

(11) Position a hydraulic jack (Fig. 115) under the bottom side of the crossmember.

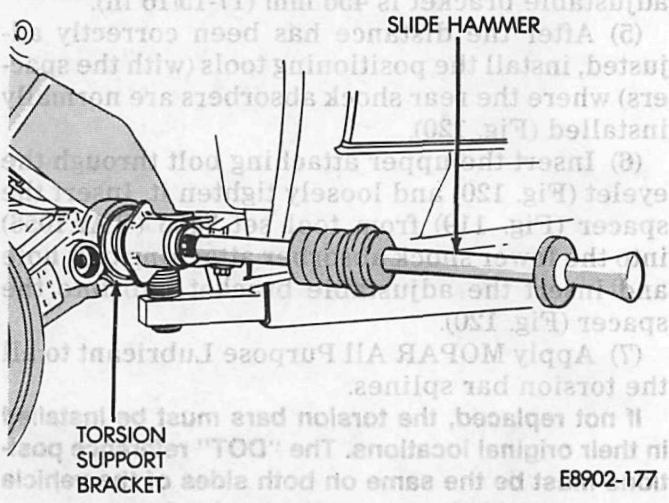


Fig. 112—Front Torsion Bar & Slide Hammer

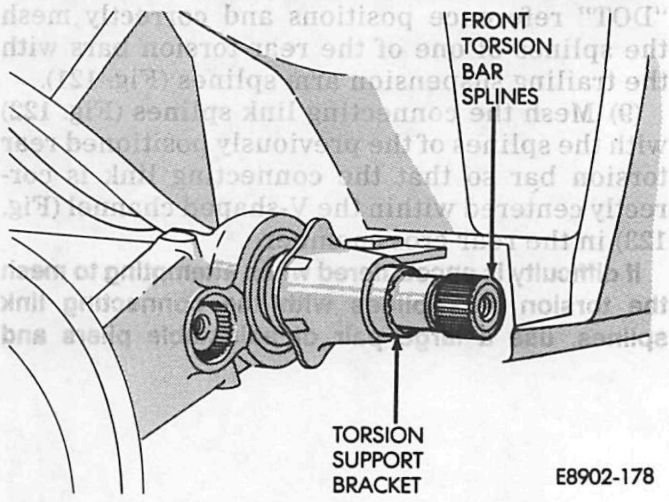


Fig. 113—Front Torsion Bar Splines

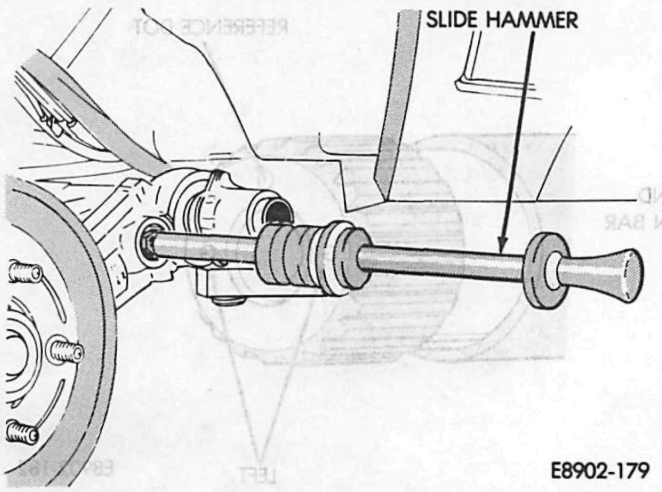


Fig. 114—Rear Torsion Bar & Slide Hammer

(12) Loosen both torsion support bracket **front** bolts (Fig. 115) approximately four turns. **Do not remove the bolts from the vehicle chassis.**

(13) Loosen both torsion support bracket **rear** bolts (Fig. 115) approximately ten turns. **Do not remove the bolts from the vehicle chassis.**

(14) Slowly lower the hydraulic jack until the torsion support bracket and the crossmember have been lowered approximately 25 mm (1 in).

(15) Remove the torsion bars from the crossmember (Fig. 116).

(16) Remove the torsion bar connecting link (Fig. 117) from the crossmember.

Installation

Ensure that the stamped letter on the outer end of each torsion bar (Fig. 118) corresponds to the side of the vehicle where it will be installed (i.e., G = left side, D = right side).

(1) Insert the torsion bars into the rear crossmember but not far enough to engage the torsion

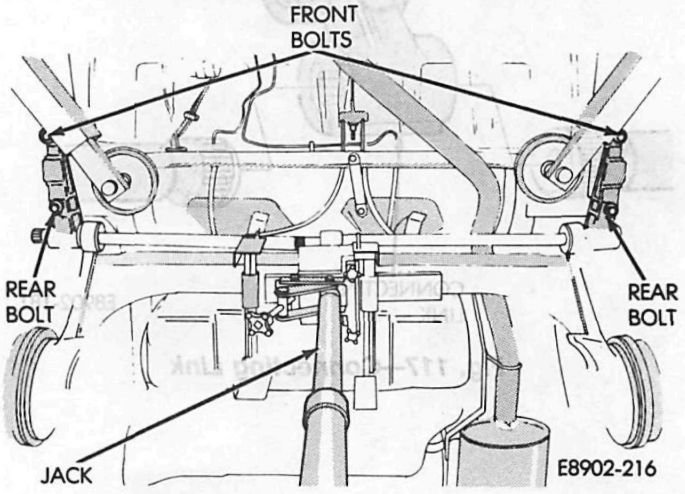


Fig. 115—Hydraulic Jack Positioned Under Crossmember

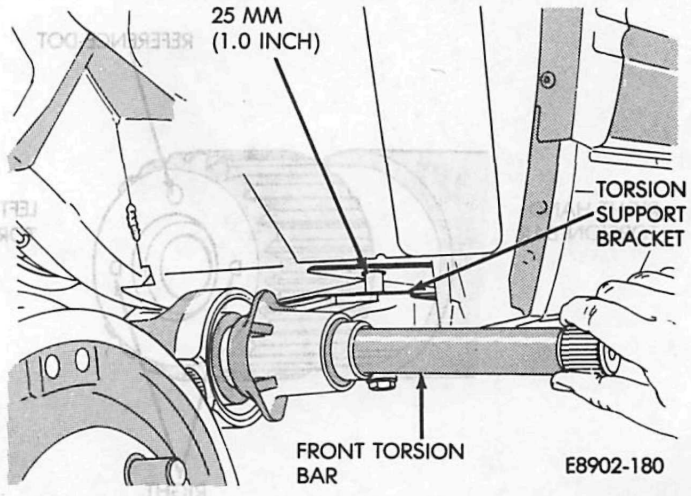


Fig. 116—Torsion Bar Removal

bar splines with the splines in the torsion support brackets or the trailing suspension arms at this time.

(2) Raise the crossmember and the torsion support bracket with the hydraulic jack and tighten the front and rear torsion support bracket attaching bolts (Fig. 115) with 92 N·m (68 ft-lbs) torque.

Before the torsion bar splines are meshed with the connecting link splines, the torsion support bracket splines and the trailing suspension arm splines, the trailing suspension arms must be positioned at the correct location in relation to the vehicle chassis.

(3) Position the trailing suspension arms at the correct location on each side of the vehicle (Fig. 119) with two sets of Threaded Rod Tool 6049 (Sus.Lm.02). Two spacers (Fig. 119) from tool set 7466 (T.Ar. 1056) must also be used.

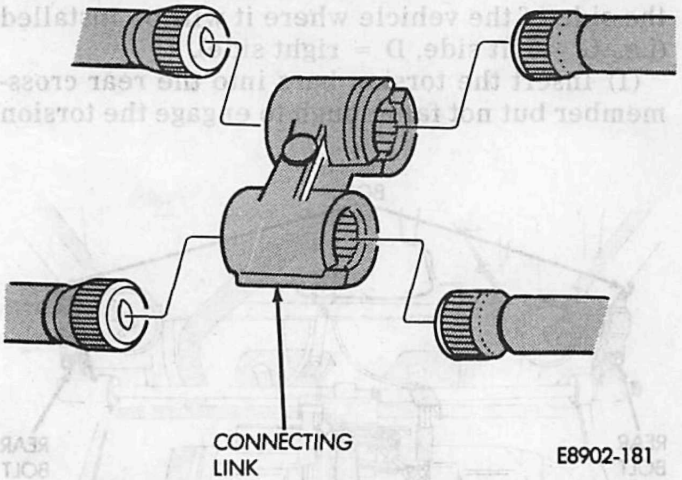


Fig. 117—Connecting Link

(4) Adjust each positioning tool (Fig. 119, Fig. 120) so that the distance between the center of the rod eyelet and the center of the hub on the adjustable bracket is 456 mm (17-15/16 in).

(5) After the distance has been correctly adjusted, install the positioning tools (with the spacers) where the rear shock absorbers are normally installed (Fig. 120).

(6) Insert the upper attaching bolt through the eyelet (Fig. 120) and loosely tighten it. Insert the spacer (Fig. 119) from tool set 7466 (T.Ar.1056) into the lower shock absorber attaching bolt hole and insert the adjustable bracket hub into the spacer (Fig. 120).

(7) Apply MOPAR All Purpose Lubricant to all the torsion bar splines.

If not replaced, the torsion bars must be installed in their original locations. The "DOT" reference positions must be the same on both sides of the vehicle to prevent added stress to the torsion bars.

(8) Refer to the previously noted torsion bar "DOT" reference positions and correctly mesh the splines of one of the rear torsion bars with the trailing suspension arm splines (Fig. 121).

(9) Mesh the connecting link splines (Fig. 122) with the splines of the previously positioned rear torsion bar so that the connecting link is correctly centered within the V-shaped channel (Fig. 123) in the rear crossmember.

If difficulty is encountered when attempting to mesh the torsion bar splines with the connecting link splines, use a large pair of adjustable pliers and

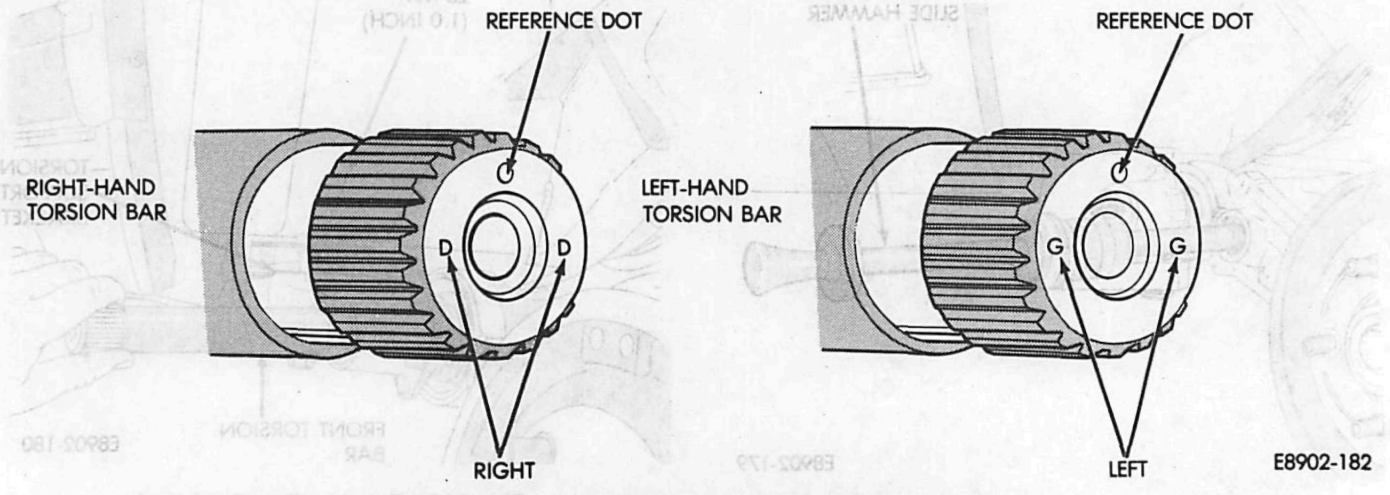


Fig. 118—Right & Left Torsion Bar Identification

slightly twist the connecting link (Fig. 122) up or down to align the splines.

(10) Mesh the splines of the opposite rear torsion bar (Fig. 121) with the trailing suspension arm splines and the connecting link splines (Fig. 122).

(11) Mesh the splines of one of the front torsion bars (Fig. 121) with the torsion support bracket splines and the connecting link splines (Fig. 122).

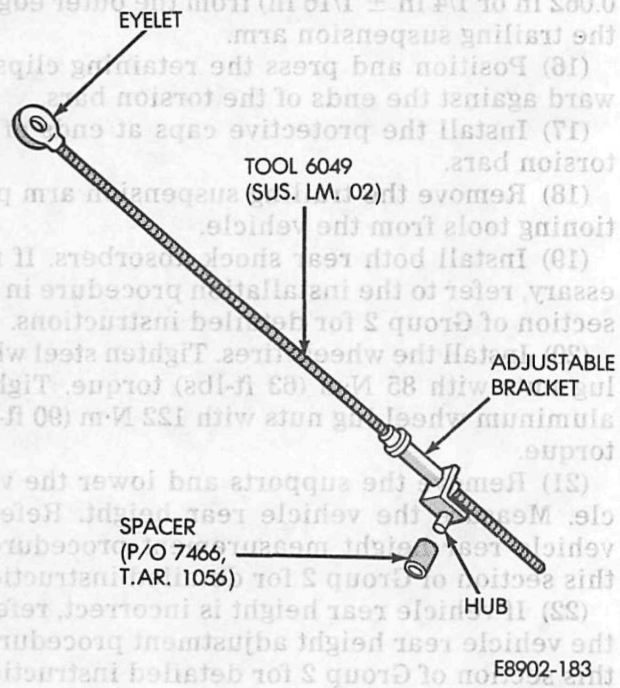


Fig. 119—Trailing Suspension Arm Positioning Tool

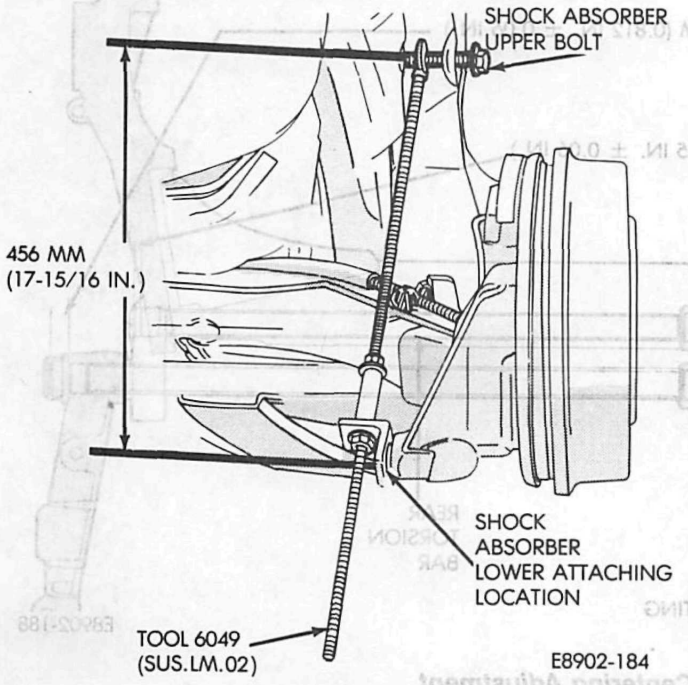


Fig. 120—Positioning Tool Installation

(12) Mesh the splines of the opposite front torsion bar (Fig. 121) with the torsion support bracket splines and the connecting link splines (Fig. 122).

If not replaced, ensure that all four torsion bars have been installed at their original locations.

(13) If the trailing suspension arm positioning distance was adjusted correctly on the positioning tools and the torsion bars are installed correctly at their original locations, the torsion bar splines should have easily meshed with the

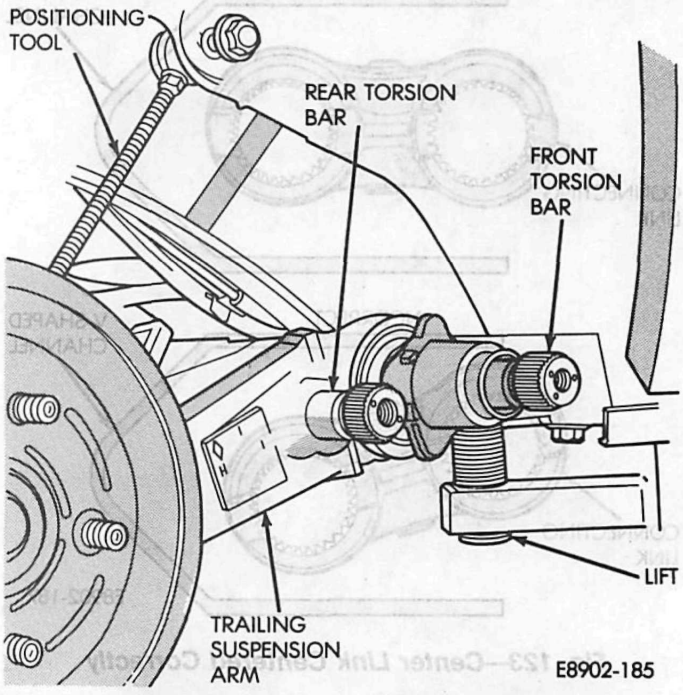


Fig. 121—Torsion Bar Installation

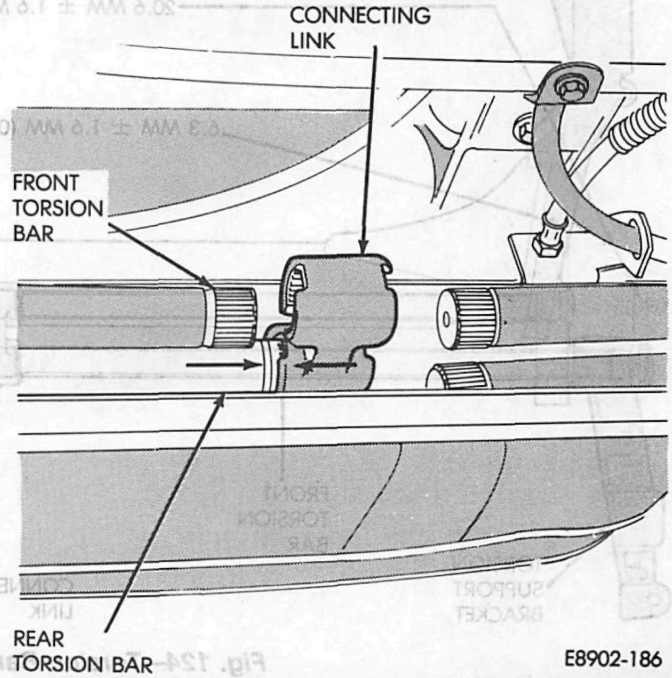


Fig. 122—Connecting Link Installation

splines in the trailing suspension arms, in the torsion support brackets and in the connecting link without force.

After the four torsion bars have been installed, the ends must be correctly centered in the torsion support brackets and the trailing suspension arms.

Do not directly contact the torsion bar splined-ends with a hammer because this could damage the splines.

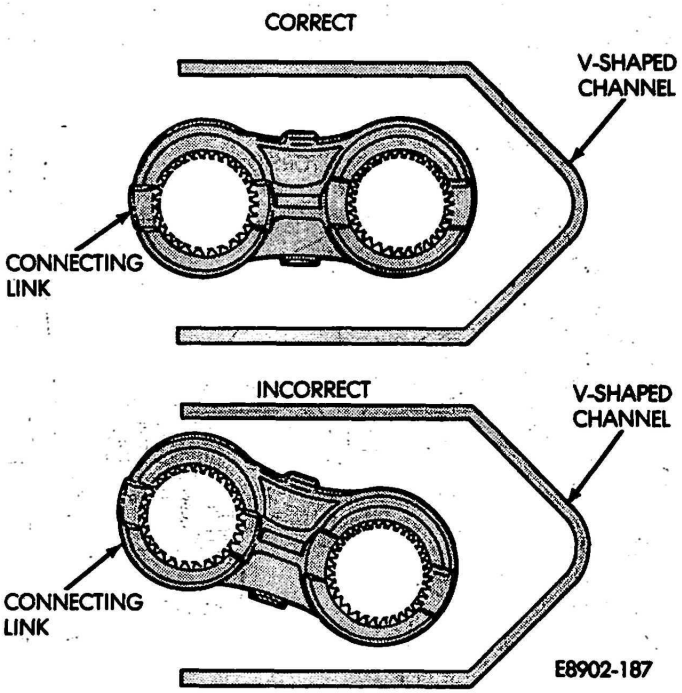


Fig. 123—Center Link Centered Correctly

(14) "Tap" on the ends of the front torsion bars with a hammer and a large brass drift punch to adjust the position of the outer end of each bar so that it is recessed (Fig. 124) 20.6 mm ± 1.6 mm (0.812 in ± 0.062 in or 13/16 in ± 1/16 in) from the outer edge of the torsion support bracket boss.

(15) "Tap" on the ends of the rear torsion bars with a hammer and a large drift punch to adjust the position of the outer end of each bar so that it is recessed (Fig. 124) 6.3 mm ± 1.6 mm (0.250 in ± 0.062 in or 1/4 in ± 1/16 in) from the outer edge of the trailing suspension arm.

(16) Position and press the retaining clips inward against the ends of the torsion bars.

(17) Install the protective caps at ends of the torsion bars.

(18) Remove the trailing suspension arm positioning tools from the vehicle.

(19) Install both rear shock absorbers. If necessary, refer to the installation procedure in this section of Group 2 for detailed instructions.

(20) Install the wheels/tires. Tighten steel wheel lug nuts with 85 N·m (63 ft-lbs) torque. Tighten aluminum wheel lug nuts with 122 N·m (90 ft-lbs) torque.

(21) Remove the supports and lower the vehicle. Measure the vehicle rear height. Refer to vehicle rear height measurement procedure in this section of Group 2 for detailed instructions.

(22) If vehicle rear height is incorrect, refer to the vehicle rear height adjustment procedure in this section of Group 2 for detailed instructions.

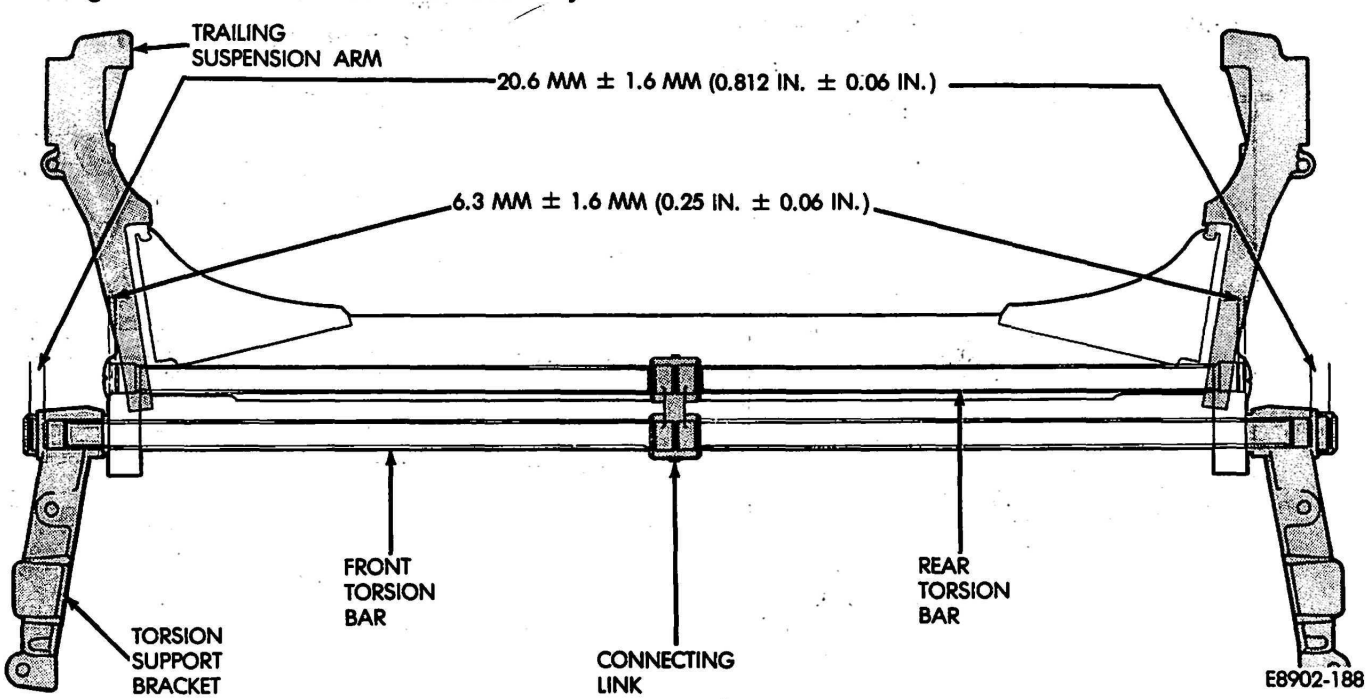


Fig. 124—Torsion Bar Centering Adjustment

REAR CROSSMEMBER

Service Information

The rear crossmember consists of a V-shaped channel with a trailing suspension arm attached to each end (Fig. 125). A torsion support bracket is connected to each trailing suspension arm with a rubber bushing (Fig. 125).

The crossmember is connected to the vehicle chassis via the two torsion support brackets. Refer to this section of Group 2 for information involving the torsion support bracket bushings.

The stub axle shafts are connected to the trailing suspension arms (Fig. 125). Refer to this section of Group 2 for information involving the stub axle shafts.

If any portion of the crossmember (Fig. 125) is bent or deformed, the complete rear crossmember must be replaced.

It is not necessary to remove the rear crossmember for torsion bar replacement and, normally, it is not necessary for the torsion bars to be removed from the crossmember before the rear crossmember is removed.

If torsion bar replacement is necessary, refer to the removal/installation procedures in this section of Group 2 for detailed instructions.

Camber And Wheel Toe Angle Measurements

Although the camber angle and the wheel toe angle are not adjustable, they should be measured with accurate alignment equipment if abnormal vehicle "driveability" or damage to the crossmember (or vehicle) suggests that the angles are possibly no longer within the specified tolerances. Refer to the Rear Camber & Wheel Toe Specifications chart.

If the measurements indicate that the camber angle and/or toe angle are out of tolerance, as applicable, replace the rear crossmember or repair/replace any other suspension component(s) that caused the angle(s) to be altered.

Removal

CAUTION: NEVER raise an Eagle Premier vehicle with a "lift" positioned under the V-shaped rear crossmember. Refer to the vehicle lifting procedure in Group 0 for detailed lifting instructions. A hydraulic jack (or other supporting (device) may be placed under the crossmember only to support its weight and the weight the other rear suspension components (e.g., for removal/installation of the crossmember or for torsion bar replacement).

(1) Raise and support the rear of the vehicle.

(2) Remove the rear wheels/tires.

(3) Support the weight of the rear crossmember at each trailing suspension arm and detach the shock absorbers from the trailing suspension arms.

(4) Loosen the adjustment nuts enough so that the balls on the end of the park brake cables can be inserted through access holes in the adjustment bracket (Fig. 126). Route the cables through the body support (Fig. 126).

(5) Disconnect the brake hoses from the metal brake tubes (Fig. 127) at the top of the crossmember.

CAUTION: DO NOT apply a lifting force to the hydraulic jack positioned under the rear crossmember, otherwise damage will result.

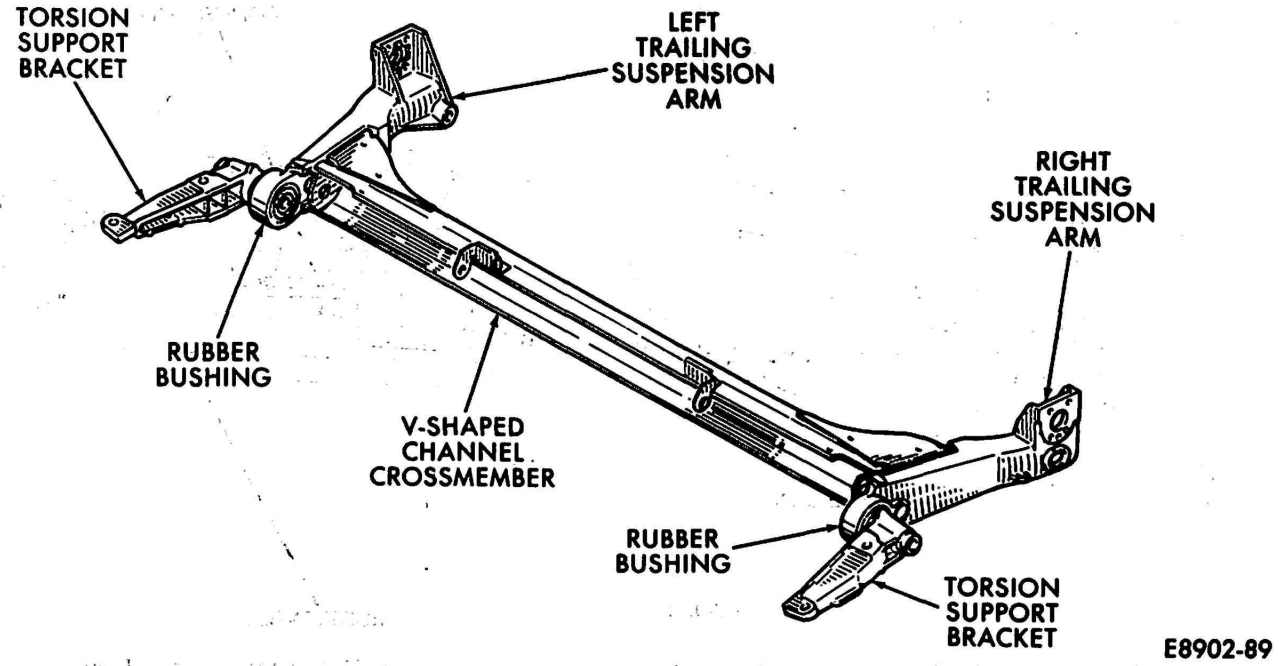
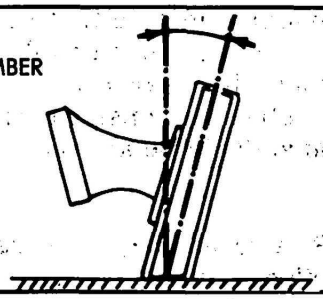
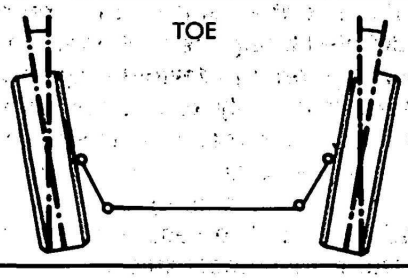


Fig. 125—Rear Crossmember

Rear Camber & Wheel Toe Specifications

MEASUREMENT	ANGLE	VEHICLE CONDITION	ADJUSTMENT
CAMBER 	−0.5° ±0.5°	UNLOADED, ON A FLAT SURFACE, FUEL TANK FULL, AND ALL TIRES WITH THE SAME RECOMMENDED PRESSURE.	NOT ADJUSTABLE
TOE 	0° ±0.23° TOE-IN OR 0 IN. ±0.196 IN. 0 mm ±4.98 mm WHEEL WITH 620 mm DIA. TIRE	UNLOADED, ON A FLAT SURFACE, FUEL TANK FULL, AND ALL TIRES WITH THE SAME RECOMMENDED PRESSURE.	NOT ADJUSTABLE

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(6) Position a hydraulic jack under the bottom side of the crossmember for support and remove the torsion support bracket bolts from each side of the vehicle chassis (Fig. 128).

(7) Lower the crossmember and remove it.

Installation

(1) Raise the rear crossmember and position the torsion support brackets so that the attaching bolts can be installed.

(2) Install and tighten the torsion support bracket bolts (Fig. 128).

(3) Connect brake hoses to the brake tubes at the top of the crossmember (Fig. 129).

(4) Route the park brake cables through the body support and connect them to the adjustment bracket (Fig. 132).

(5) Attach the shock absorber lower eyelets to the trailing suspension arms with the bolts. Tighten the bolts with 115 N·m (85 ft-lbs) torque.

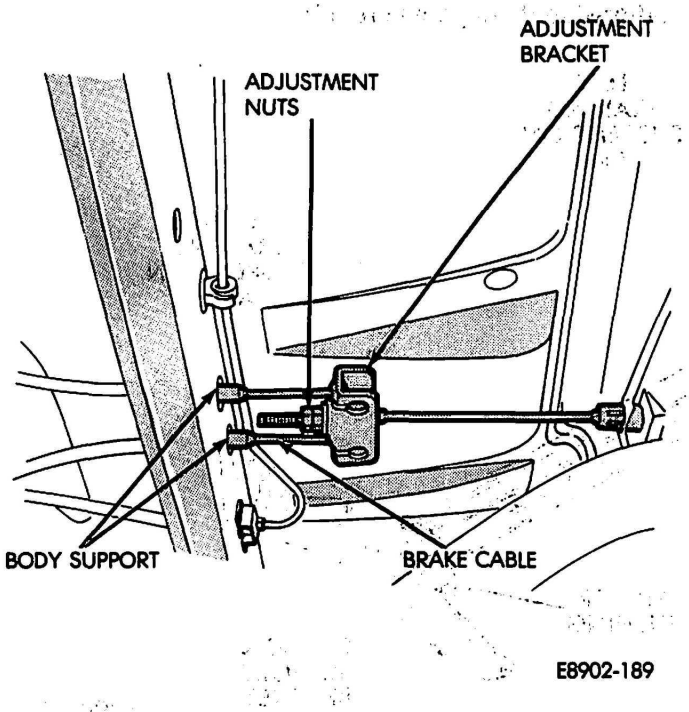


Fig. 126—Park Brake Cable Removal/Installation

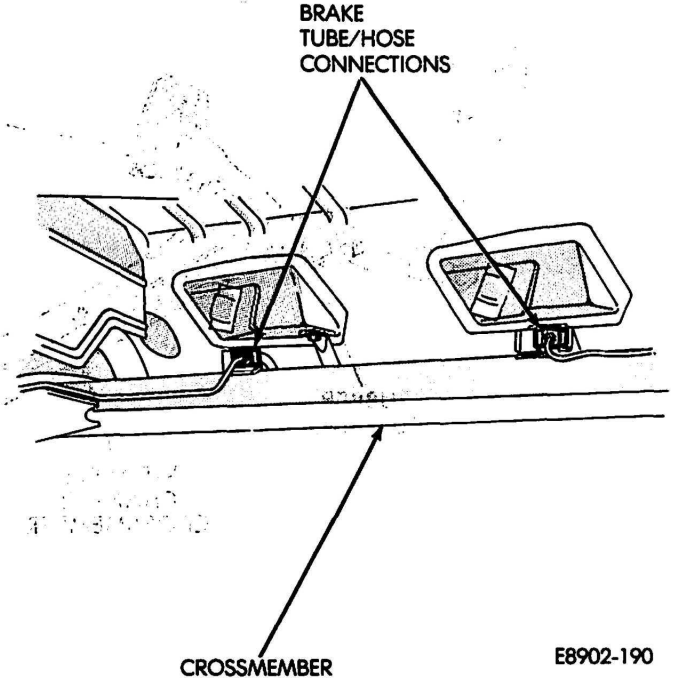


Fig. 127—Brake Tubes/Hoses

(6) Install the rear wheels/tires. Tighten steel wheel lug nuts with 85 N·m (63 ft-lbs) torque. Tighten aluminum wheel lug nuts with 122 N·m (90 ft-lbs) torque.

(7) Bleed the brakes. If necessary, refer to the procedure in Brakes—Group 5 for detailed instructions.

(8) Adjust the parking brake cables. If necessary, refer to the adjustment procedure in Brakes—Group 5 for detailed instructions.

TORSION SUPPORT BRACKET BUSHINGS

Replacement

Removal

(1) Remove the torsion bars from the crossmember. If necessary, refer to the removal procedure in this section of Group 2 for detailed instructions.

(2) Remove the rear crossmember from the vehicle. If necessary, refer to the removal procedure in this section of Group 2 for detailed instructions.

(3) Place the bushing driver tool from Bushing Removal/Installation Tool Set 7466 (T.Ar. 1056) against the bushing and install a two-jaw extractor/puller tool on the trailing suspension arm side of the bushing (Fig. 129).

(4) Turn the extractor tool bolt head and force the bushing driver tool to "drive" the bushing from the trailing suspension arm bushing bore, and to separate the torsion support bracket from the trailing suspension arm (Fig. 129).

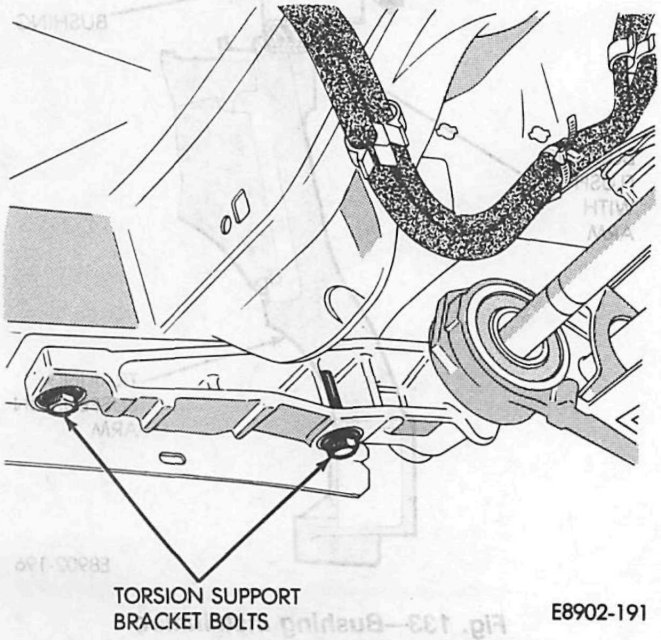


Fig. 128—Torsion Support Bracket Bolts

(5) In preparation for removing the bushing from the torsion support bracket, a round piece of metal (e.g., a 26-mm nut) must be spot welded to the inside bore of the bushing (Fig. 130).

The round piece of metal or nut (Fig. 130) must be spot welded in the bushing bore to provide a "stop" for the bushing driver when forcing the bushing from the torsion support bracket bore.

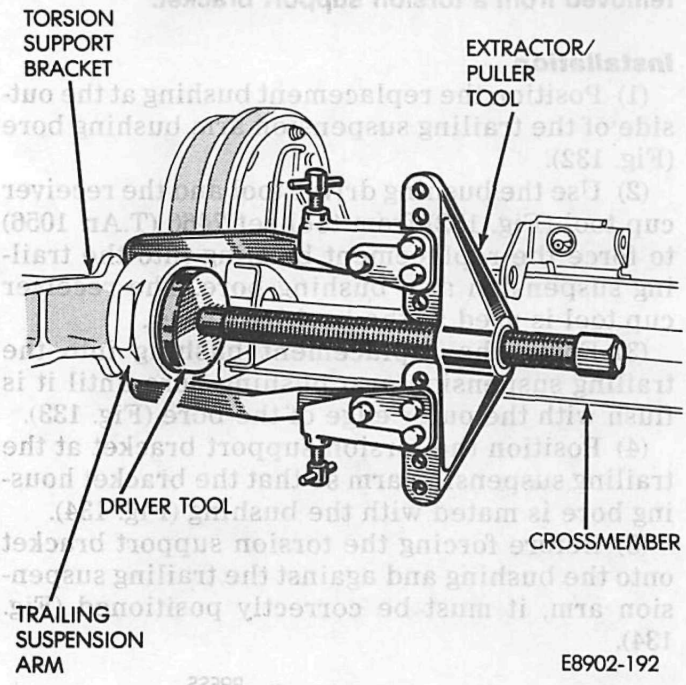


Fig. 129—Extractor/Puller Tool Installation

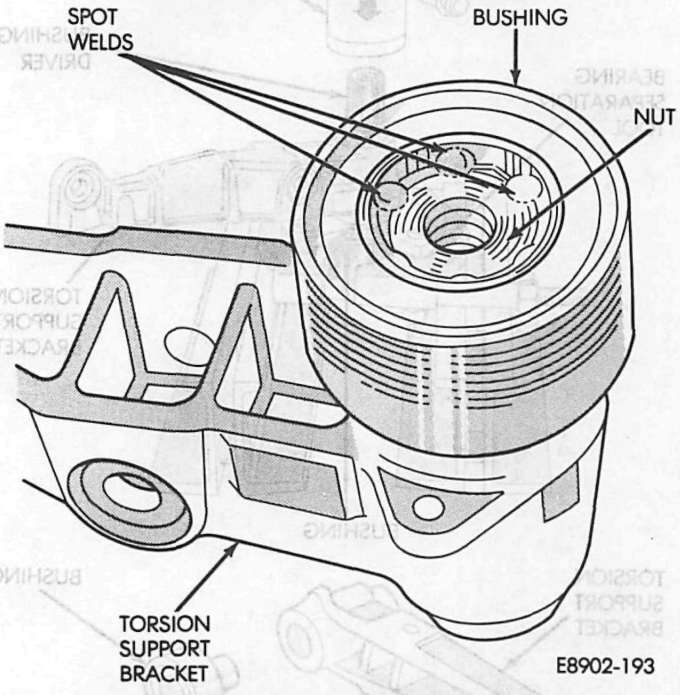


Fig. 130—Preparation for Bushing Removal

(6) Use a hydraulic press, a bushing driver tool and a bearing separation tool (or similar device) to force the bushing from the torsion support bracket bore. Use an appropriate size socket wrench or a piece of pipe with an appropriate outside diameter (OD) as a bushing driver tool (Fig. 131).

CAUTION: DO NOT reuse any bushing that has been removed from a torsion support bracket.

Installation

(1) Position the replacement bushing at the outside of the trailing suspension arm bushing bore (Fig. 132).

(2) Use the bushing driver tool and the receiver cup tool (Fig. 132) from tool set 7466 (T.Ar. 1056) to force the replacement bushing into the trailing suspension arm bushing bore. The receiver cup tool is used as the bushing driver.

(3) Force the replacement bushing into the trailing suspension arm bushing bore until it is flush with the outer edge of the bore (Fig. 133).

(4) Position the torsion support bracket at the trailing suspension arm so that the bracket housing bore is mated with the bushing (Fig. 134).

(5) Before forcing the torsion support bracket onto the bushing and against the trailing suspension arm, it must be correctly positioned (Fig. 134).

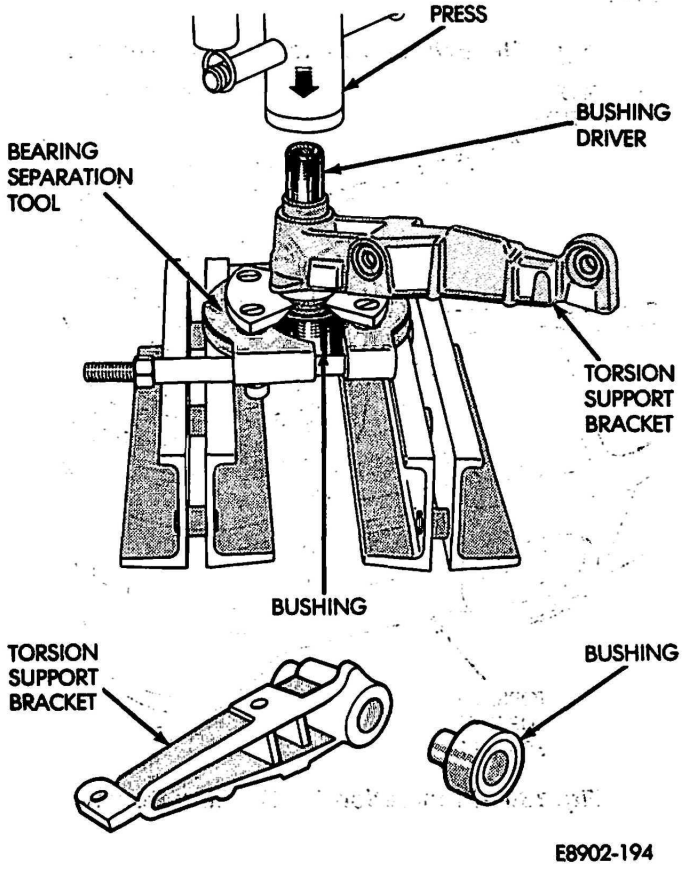


Fig. 131—Bushing Removal

(6) Place a straightedge along the top of the torsion support bracket and on the areas that contact the chassis (Fig. 134).

(7) Rotate the torsion support bracket (and straight-edge) on the bushing to obtain a distance of 23 mm ± 1 mm (7/8 in ± 1/32 in) between the stub axle shaft bore centerline and the straight-edge (Fig. 134). The torsion support bracket is now correctly positioned for installation.

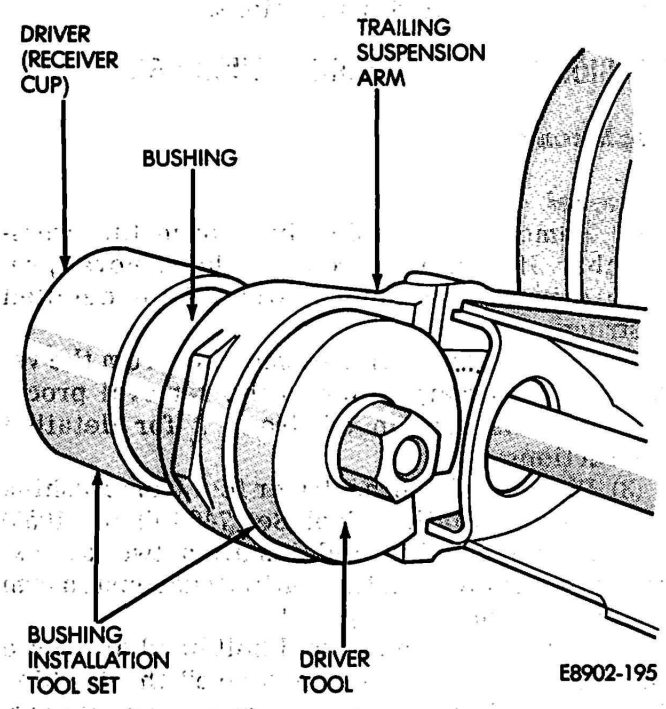


Fig. 132—Bushing Installation Tools

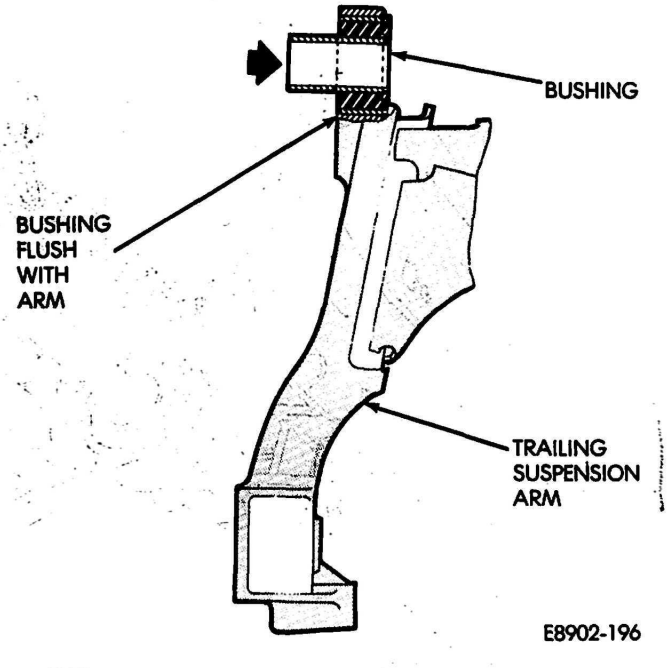


Fig. 133—Bushing Installation

(8) When the torsion support bracket is correctly positioned (Fig. 135), force the bushing into the bushing bore (and force the torsion support bracket against the trailing suspension arm) with Bushing Removal/Installation Tool Set 7466 (T.Ar. 1056).

(9) Force the bushings into the left and right torsion support bracket bushing bores until the distance between the two rear bolt-hole centerlines is 132 cm or 52 inches (Fig. 136).

The distance between the left and right bolt-hole centerlines is critical because it establishes the correct installation alignment between the bolt holes and the nut plates on the vehicle chassis.

(10) Install the rear crossmember on the vehicle but do not tighten the attaching bolts until after the torsion bars have been installed. If necessary, refer to the installation procedure in this section of Group 2 for detailed instructions.

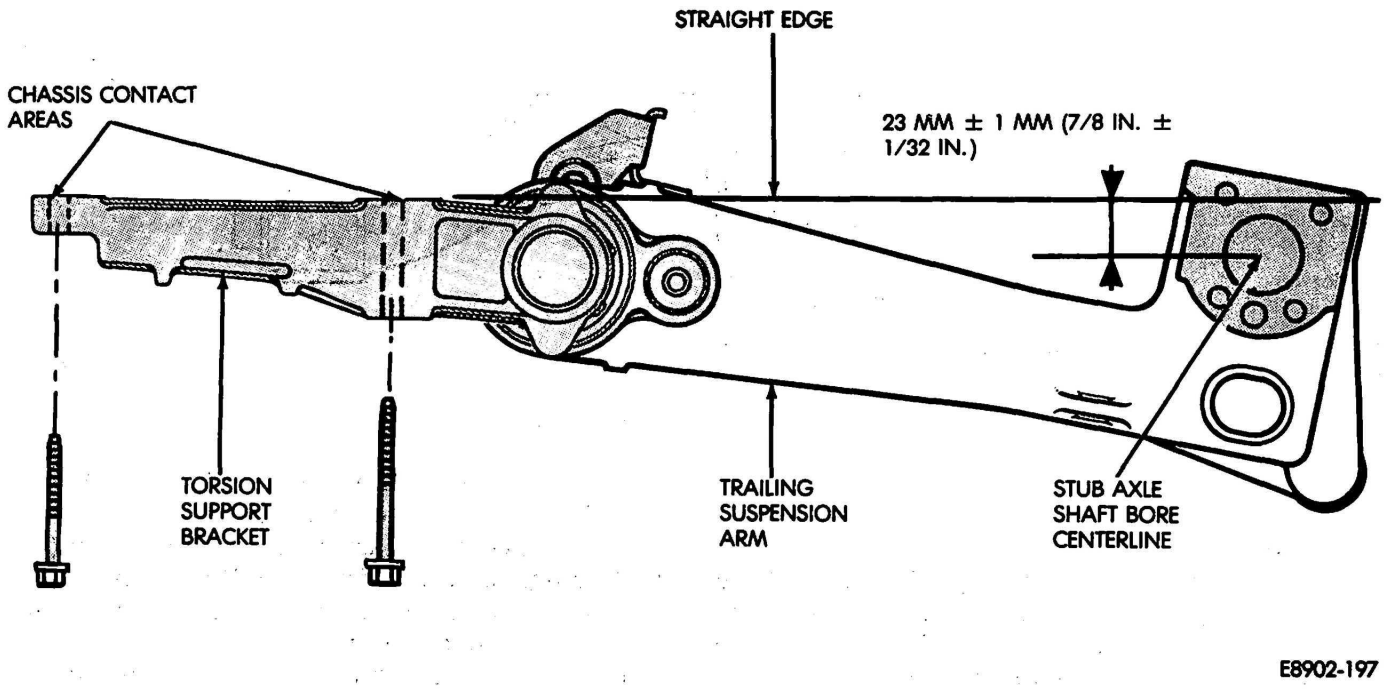


Fig. 134—Torsion Support Bracket Positioning

(11) Install the torsion bars in the rear crossmember. If necessary, refer to the installation procedure in this section of Group 2 for detailed instructions.

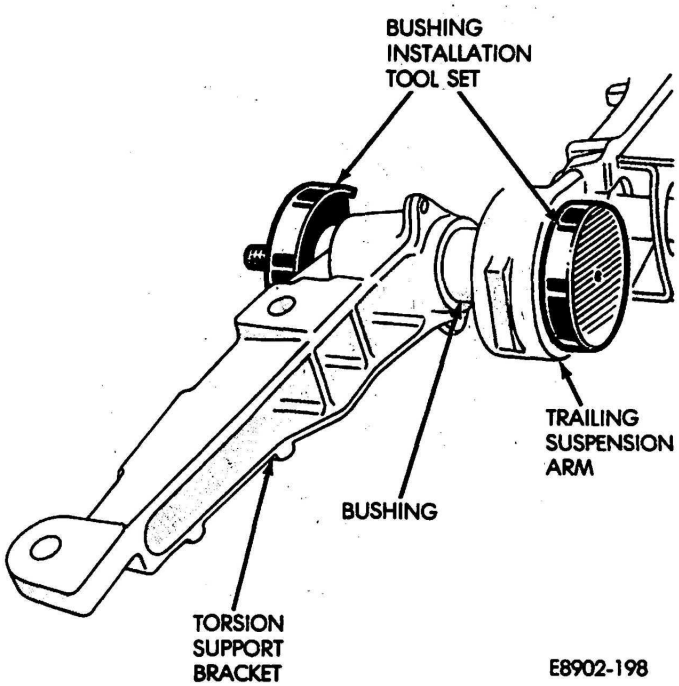


Fig. 135—Torsion Support Bracket Installation

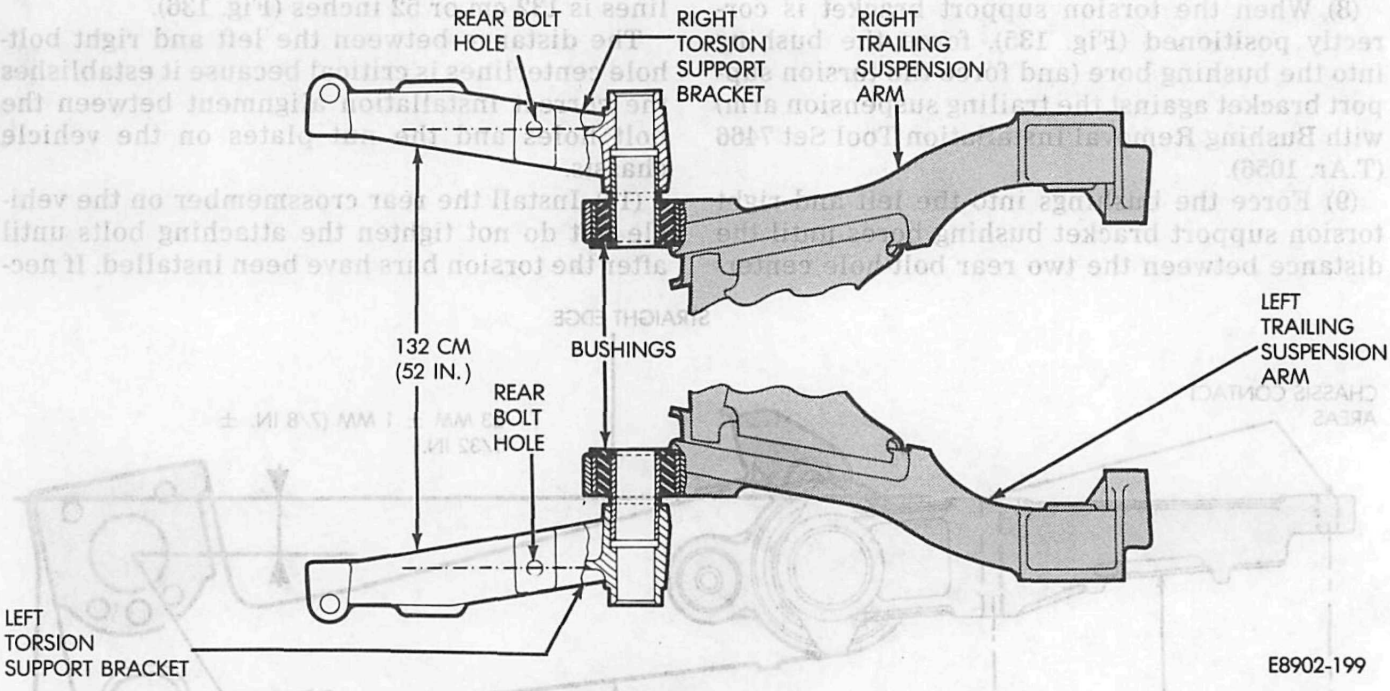


Fig. 136—Installation Specifications

STUB AXLE SHAFT

Removal

CAUTION: NEVER raise an Eagle Premier vehicle with a "lift" positioned under the V-shaped rear crossmember. Refer to the vehicle lifting procedure in Group 0 for detailed lifting instructions.

(1) Raise and support the rear of the vehicle.

(2) Remove the wheel/tire.

(3) Remove the safety nuts (Fig. 137) that retain the brakedrum on the wheel hub.

(4) Remove the plastic wheel hub cover (Fig. 137) by prying it off with a small pry bar.

(5) Remove the brakedrum from the wheel hub by pulling it straight out and off.

If the brakedrum can not be easily removed, refer to Brakes—Group 5 for additional information.

(6) Remove the stub axle shaft-to-wheel hub locknut (Fig. 138).

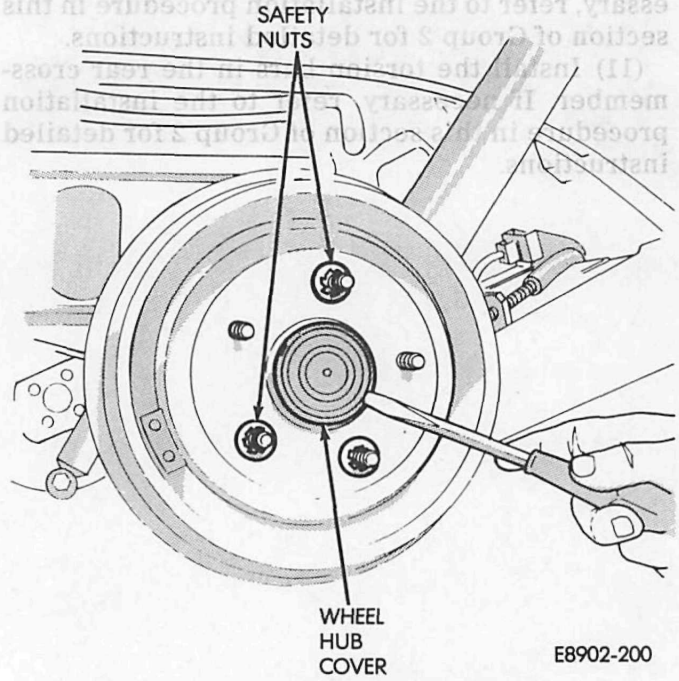


Fig. 137—Brakedrum Removal

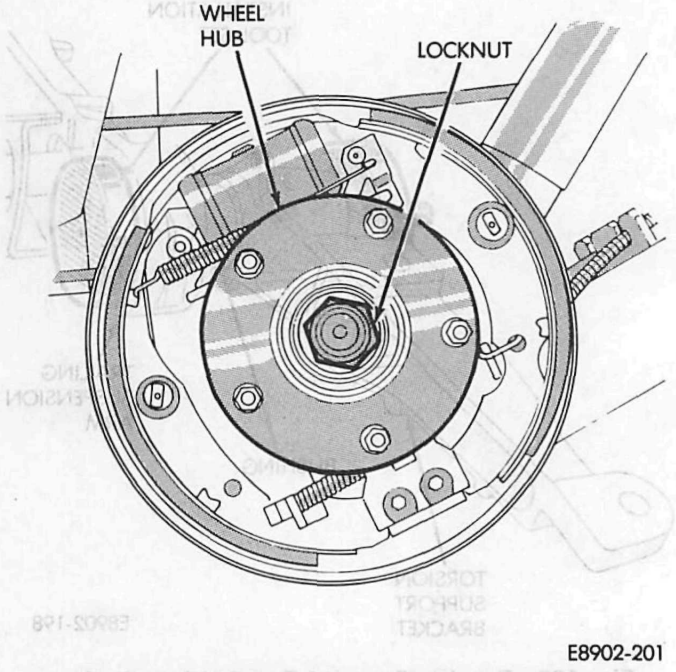


Fig. 138—Wheel Hub Removal

(7) Remove the wheel hub (Fig. 138) from the stub axle shaft. If necessary, use a hub puller tool to remove the wheel hub from the stub axle shaft.

(8) Remove the Allen-head bolts that attach the stub axle shaft to the trailing suspension arm (Fig. 139).

(9) Remove the bolt (Fig. 139) that attaches the brake backing plate to the stub axle shaft.

(10) Remove the stub axle shaft (and shim) from the trailing suspension arm (Fig. 140). Remove the drum brake backing plate from the stub axle shaft.

Installation

Drum **and** Disc brake assemblies require that the alignment shim be installed as shown in figure 140 during reassembly.

(1) Position the drum brake backing plate on the stub axle shaft.

(2) Position the stub axle shaft (with the brake backing plate) on the trailing suspension arm (Fig. 139).

(3) Install the brake backing plate attaching bolt (Fig. 139) "finger-tight."

If the Allen-head bolts (Fig. 139) are being reused, apply Loctite 271 to the threads.

(4) Install the Allen-head bolts (Fig. 139) and tighten them in the correct sequence (Fig. 139) with 64 N·m (47 ft-lbs) torque.

(5) Tighten the brake backing plate attaching bolt (Fig. 139) with 16 N·m (12 ft-lbs) torque.

(6) Lightly lubricate the stub axle shaft and install the wheel hub on the stub axle shaft.

(7) Install and tighten the replacement stub axle shaft-to-wheel hub locknut with 167 N·m (123 ft-lbs) torque (Fig. 138).

(8) Install the brakedrum with replacement safety nuts on the wheel hub (Fig. 137).

(9) Install the plastic wheel hub cover.

(10) Install the wheel/tire. Tighten steel wheel lug nuts with 85 N·m (63 ft-lbs) torque. Tighten aluminum wheel lug nuts with 122 N·m (90 ft-lbs) torque.

(11) Test the brakes and parking brake for proper operation. If necessary, refer to Brakes—Group 5 for additional information.

(12) Remove the supports and lower the vehicle.

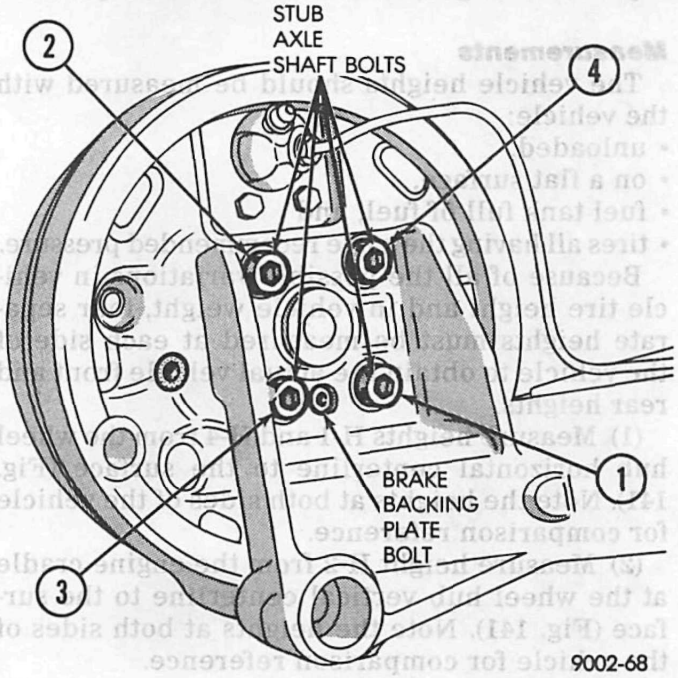


Fig. 139—Stub Axle Bolts and Bolt Tightening Sequence

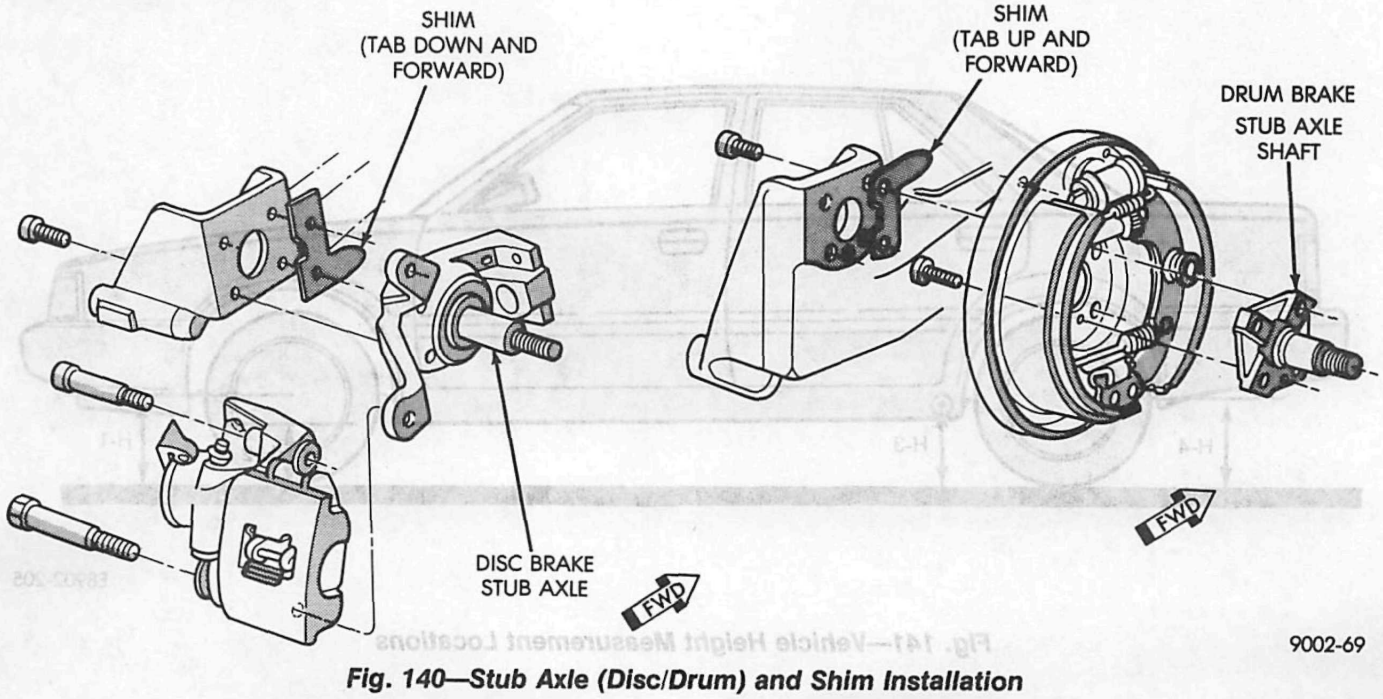


Fig. 140—Stub Axle (Disc/Drum) and Shim Installation

VEHICLE HEIGHT

Service Information

The vehicle rear height is adjusted by positioning the trailing suspension arms at the specified distance from the vehicle chassis and then rotating the front torsion bars from their original position to the position that will provide the correct vehicle rear height.

The vehicle front height is not adjustable and, if necessary, must be corrected by replacement/repair of damaged, worn or defective components.

Measurements

The vehicle heights should be measured with the vehicle:

- unloaded,
- on a flat surface,
- fuel tank full of fuel, and
- tires all having the same recommended pressure.

Because of all the possible variations in vehicle tire height and in vehicle weight, four separate heights must be measured at each side of the vehicle to obtain the actual vehicle front and rear heights.

(1) Measure heights H-1 and H-4 from the wheel hub horizontal centerline to the surface (Fig. 141). Note the heights at both sides of the vehicle for comparison reference.

(2) Measure height H-2 from the engine cradle at the wheel hub vertical centerline to the surface (Fig. 141). Note the heights at both sides of the vehicle for comparison reference.

(3) Measure height H-3 from the front torsion bar horizontal centerline to the surface (Fig. 141, Fig. 142) Note the heights at both sides of the vehicle for comparison reference.

(4) Compare the height measurements from each side of the vehicle with the acceptable front and rear heights:

- front—H1 minus H2 should equal 93 mm ± 8 mm (3.67 in ± 0.31 in), and
- rear—H4 minus H3 should equal 39.5 mm ± 8 mm (1.56 in ± 0.31 in).

(5) If necessary, adjust the vehicle left and right rear heights. Refer to the adjustment procedure in this section of Group 2 for detailed instructions.

(6) If either or both of the vehicle front heights are not correct, locate and replace/repair the damaged, worn or defective component that is causing the height variation.

Adjustment

(1) If necessary, measure the vehicle heights. Refer to the measurement procedure in this section of Group 2 for detailed instructions.

(2) Determine and note the height change(s) that will be necessary to raise or lower the vehicle to obtain the acceptable vehicle height.

(3) Raise and support the rear of the vehicle.

(4) Remove both rear wheels/tires.

(5) Remove both shock absorbers. If necessary, refer to the removal procedure in this section of Group 2 for detailed instructions.

(6) Pry the protective caps from the torsion support brackets (Fig. 143) at both sides of vehicle.

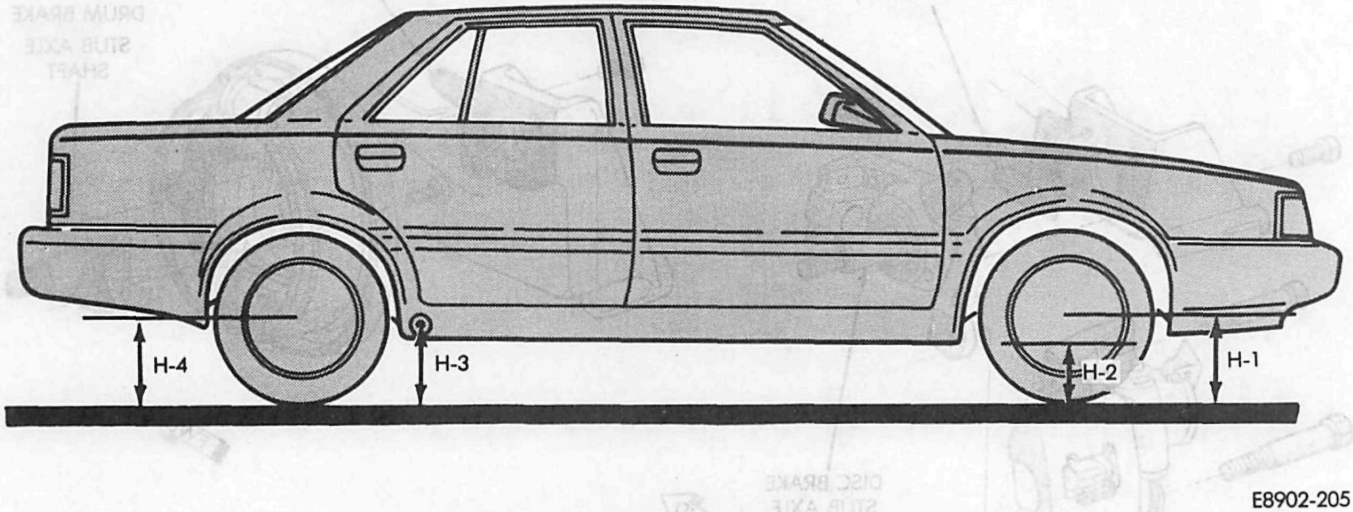


Fig. 141—Vehicle Height Measurement Locations

(7) Pry the retaining clips (Fig. 144) from the ends of the front torsion bars.

CAUTION: NEVER attempt to change the vehicle height with the rear torsion bars.

(8) Pull both front torsion bars out far enough from the torsion support brackets to disengage the splines with a slide hammer (Fig. 145, Fig. 146).

Before the front torsion bar splines are re-meshed with the connecting link splines and the torsion support bracket splines the trailing suspension arms must be positioned at the correct location in relation to the vehicle chassis.

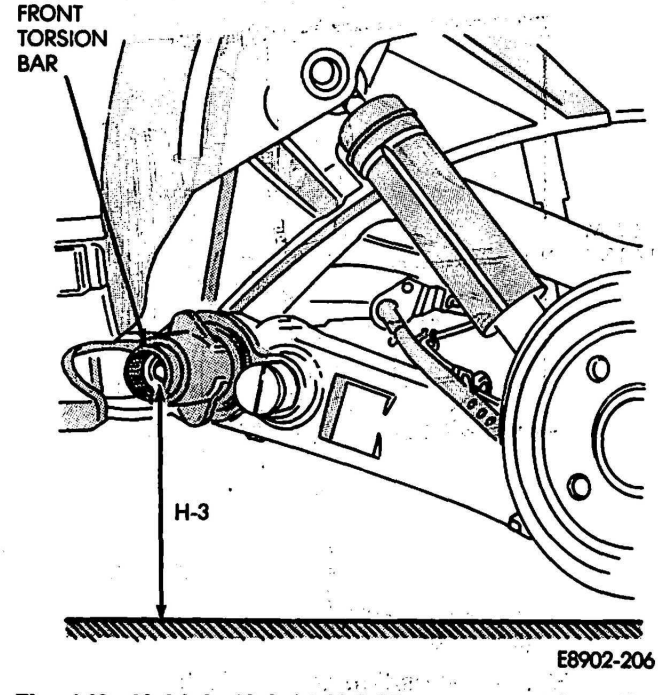


Fig. 142—Vehicle Height H-3 Measurement Location

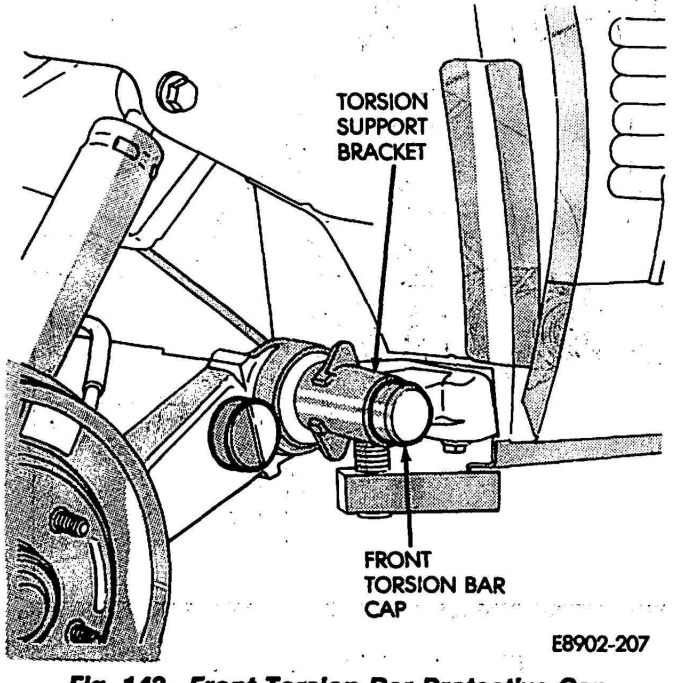


Fig. 143—Front Torsion Bar Protective Cap

(9) Position the trailing suspension arms at the correct location on each side of the vehicle (Fig. 147) with two sets of Threaded Rod Tool 6049 (Sus.Lm.02). Two spacers (Fig. 147) from tool set 7466 (T.Ar.1056) must also be used.

(10) Adjust each positioning tool (Fig. 147, Fig. 148) so that the distance between the center of the rod eyelet and the center of the hub on the adjustable bracket is 456 mm (17-15/16 in).

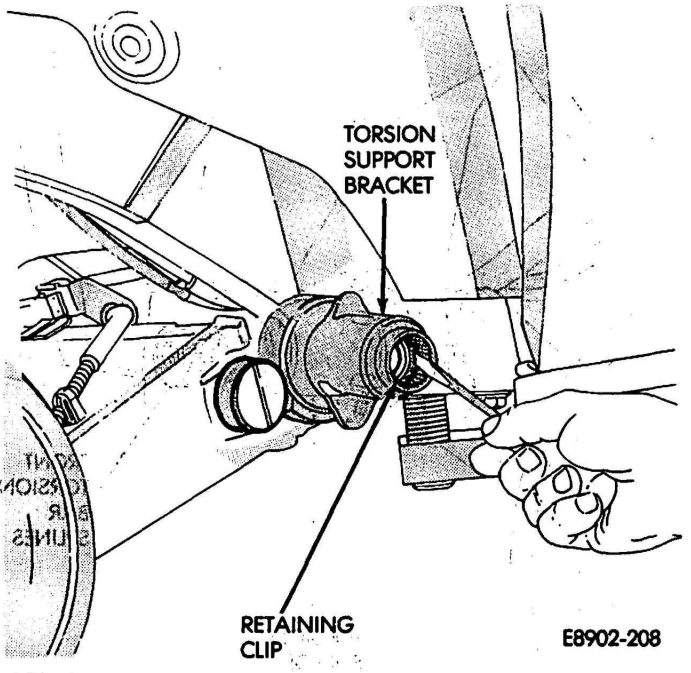


Fig. 144—Retaining Clip Removal

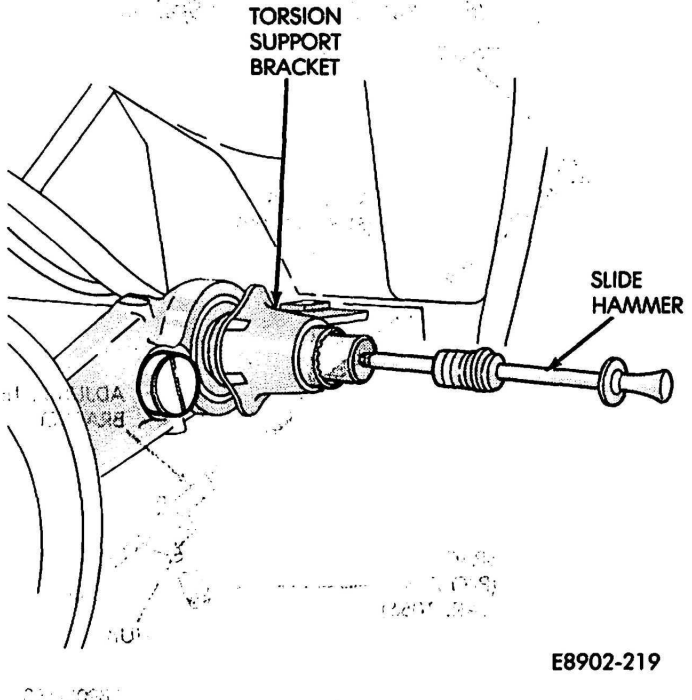


Fig. 145—Front Torsion Bar And Slide Hammer

(11) After the distance has been correctly adjusted, install the positioning tools (with the spacers) where the rear shock absorbers are normally installed (Fig. 148).

(12) Insert the upper attaching bolt through the eyelet (Fig. 148) and loosely tighten it. Insert the spacer (Fig. 154) from tool set 7466 (T.Ar.1056) into the lower shock absorber attaching bolt hole and insert the adjustable bracket hub into the spacer (Fig. 148).

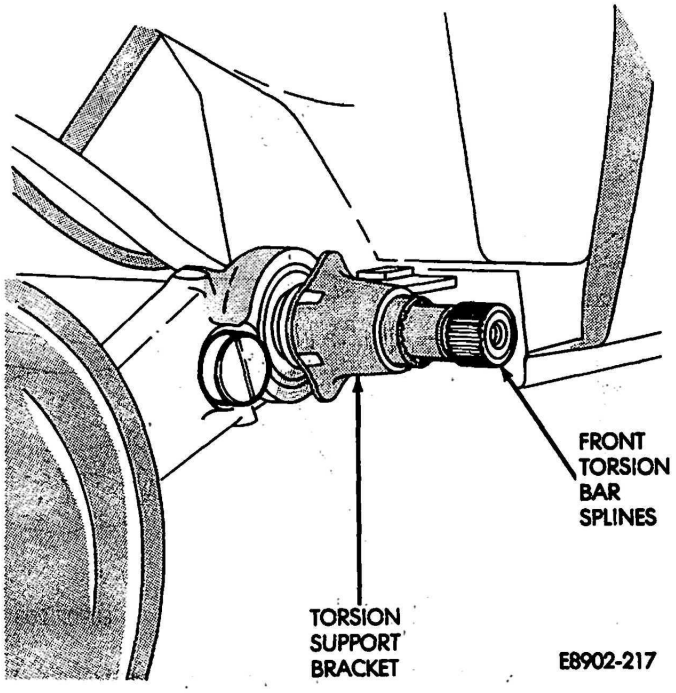


Fig. 146—Front Torsion Bar Splines

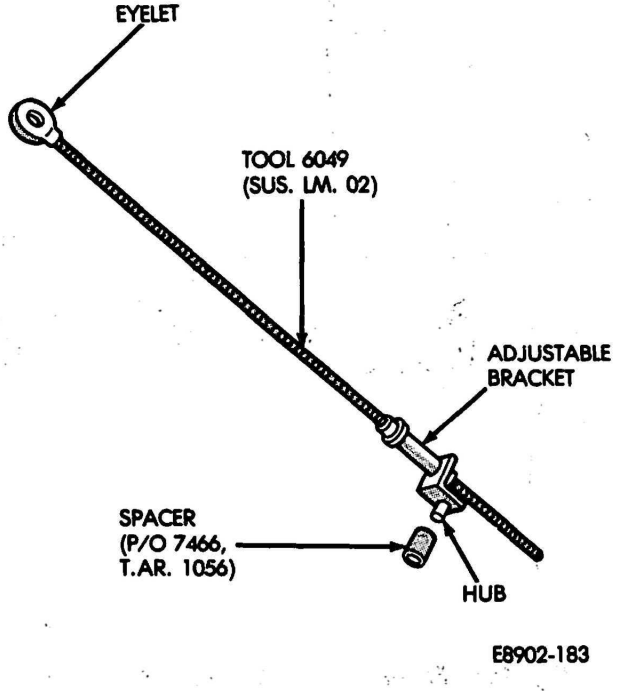


Fig. 147—Trailing Suspension Arm Positioning Tool

(13) Measure the height from the horizontal center-line of both rear wheel hubs to the surface (Fig. 149).

(14) Increase or decrease the length of the trailing suspension arm positioning tools (Fig. 148) in accordance with the height change(s) that are necessary to raise or lower the vehicle and obtain the acceptable vehicle height.

Example—It was determined the vehicle right and left rear height must be lowered 51 mm (2 in) to be acceptable. The height from the horizontal centerline

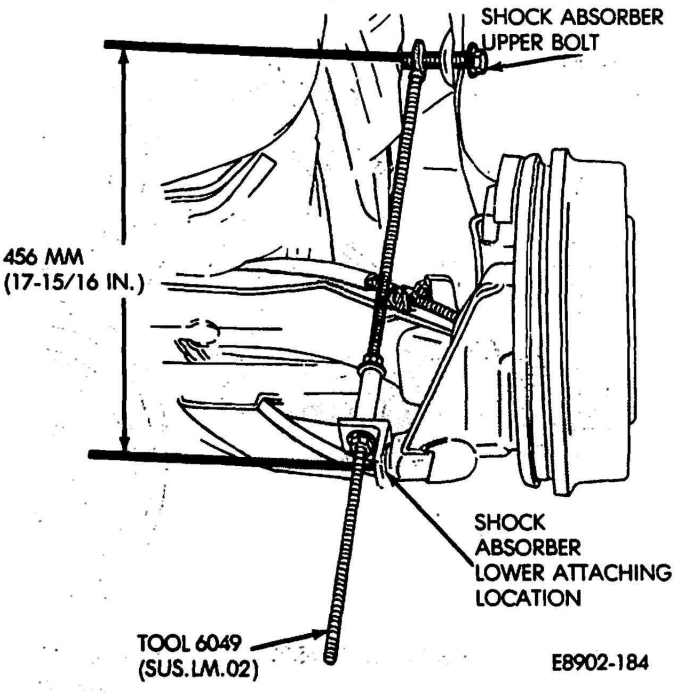


Fig. 148—Positioning Tool Installation

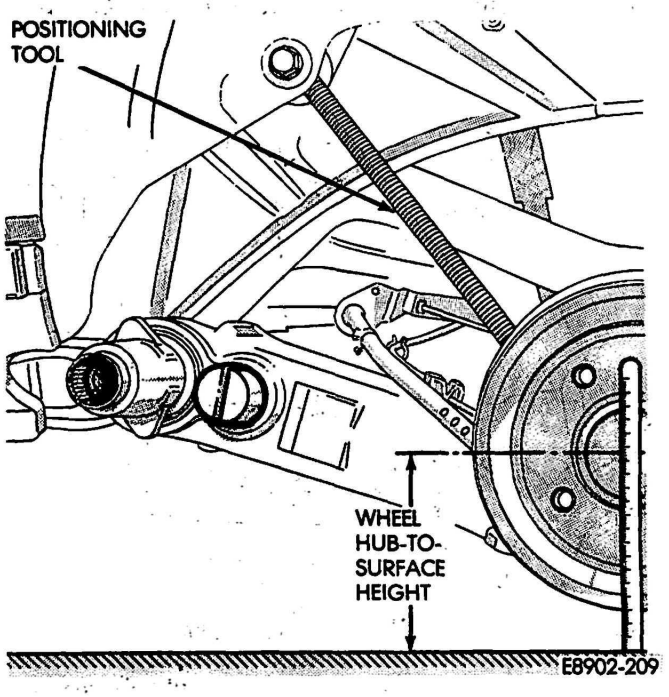


Fig. 149—Height Measurement

of both rear wheel hubs to the surface (Fig. 149) is 1 016 mm (40 in). To lower the height, decrease the length of both positioning tools until the wheel hub-to-surface height (Fig. 149) in 1 067 mm (42 in) at both sides of the vehicle.

(15) Apply MOPAR All Purpose Lubricant to the torsion bar splines.

CAUTION: Do not force a torsion bar into the "splined-meshed" position because this could cause its splines to be damaged. Gradually rotate the torsion bar spline-by-spline until simultaneous spline alignment occurs (i.e., the outer splines are aligned with the torsion support bracket splines and the inner splines are aligned with the connecting link splines). When simultaneous spline alignment occurs, the torsion bar splines will easily mesh without force.

(16) Push inward on one of the front torsion bars, gradually rotate it and mesh it splines with the torsion support bracket splines and the connecting link splines.

Count the number of splines that separate the "DOT" reference mark in the end of the installed front torsion bar and the "DOT" reference mark on the torsion support bracket (Fig. 150). The other front torsion bar must be installed on the opposite side of the vehicle with the same number of splines separating the "DOT" reference marks (Fig. 150). This will prevent unequal torque exertion on the torsion bars.

(17) Rotate the opposite front torsion bar until the number of splines that are separating the "DOT" reference marks (Fig. 150) is duplicated. Push inward on the bar and mesh its splines with the torsion support bracket splines and the connecting link splines.

After the front torsion bars have been installed, the ends must be correctly centered in the torsion support brackets (Fig. 151).

CAUTION: Do not directly contact the torsion bar splined-ends with a hammer because this could damage the splines.

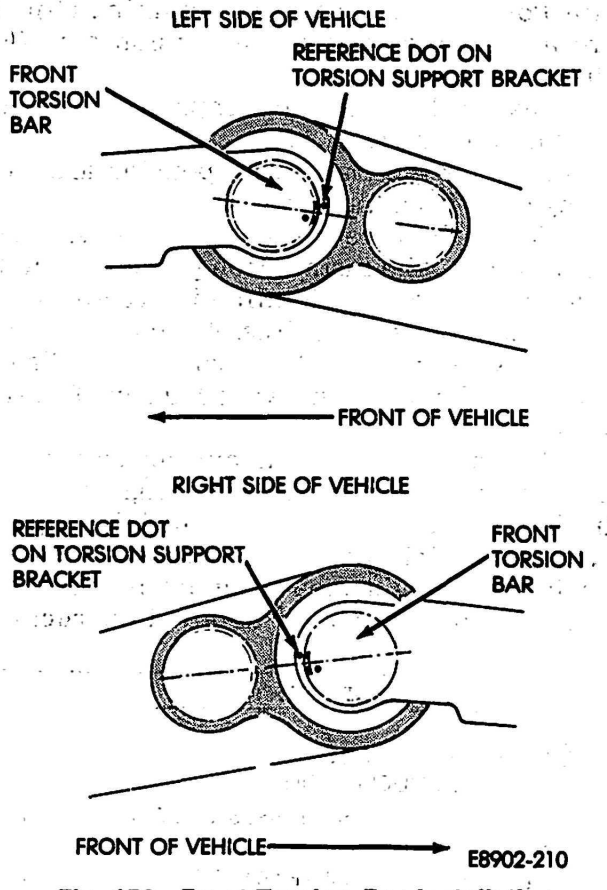


Fig. 150—Front Torsion Bar Installation

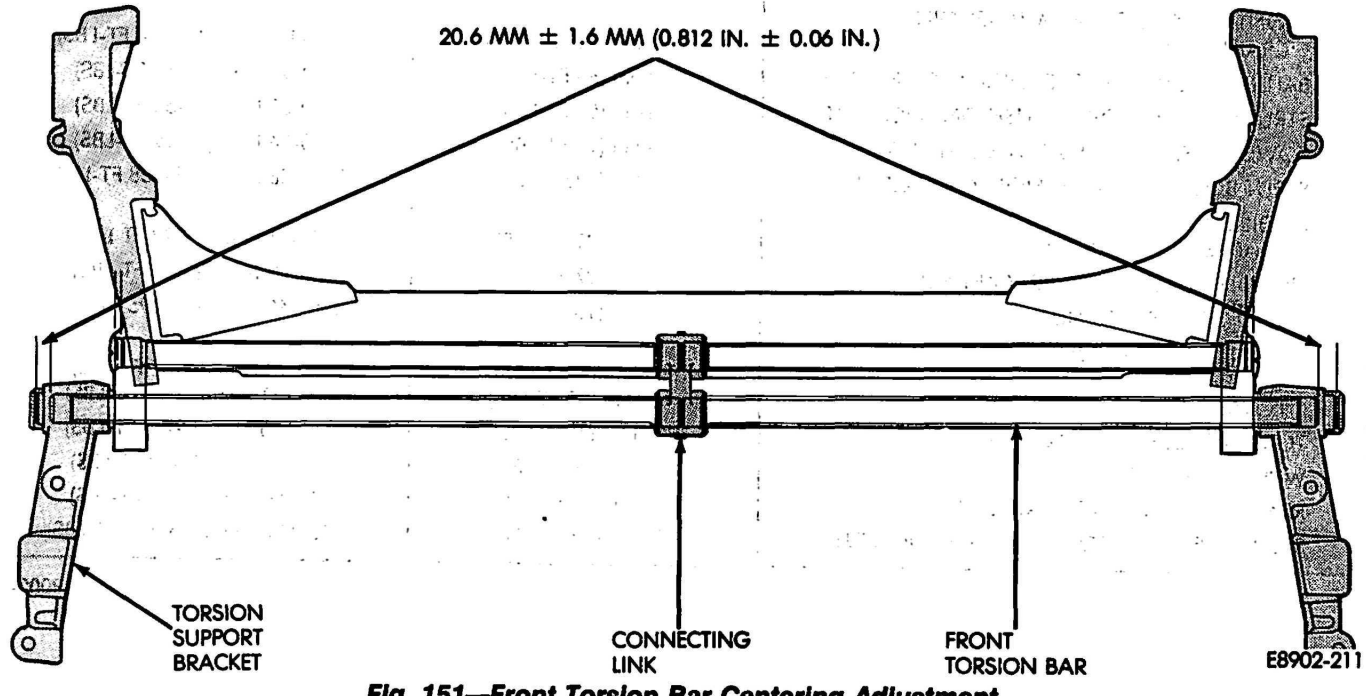


Fig. 151—Front Torsion Bar Centering Adjustment

(18) "Tap" on the ends of the front torsion bars with a hammer and a large brass drift punch to adjust the position of the outer end of each bar so that it is recessed 20.6 mm ± 1.6 mm (0.812 in ± 0.062 in or 13/16 in ± 1/16 in) from the outer edge of the torsion support bracket boss (Fig. 151).

(19) Position and press the retaining clips inward against the ends of the torsion bars (Fig. 152).

(20) Install the protective caps at ends of the front torsion bars (Fig. 143).

(21) Remove the trailing suspension arm positioning tools from the vehicle.

(22) Install both rear shock absorbers. If necessary, refer to the installation procedure in this section of Group 2 for detailed instructions.

(23) Install the wheels/tires. Tighten steel wheel lug nuts with 85 N·m (63 ft-lbs) torque. Tighten aluminum wheel lug nuts with 122 N·m (90 ft-lbs) torque.

(24) Remove the supports and lower the vehicle. Measure the vehicle rear height to determine if the adjustment accomplished the required change in vehicle height. If necessary, refer to vehicle rear height measurement procedure in this section of Group 2 for detailed instructions.

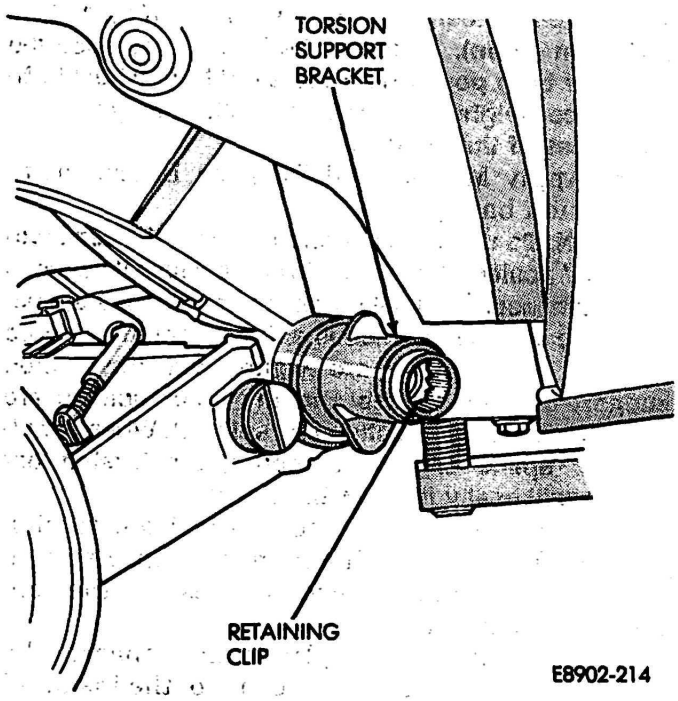


Fig. 152—Retaining Clip Installation

COMPONENT	SET-TO-TORQUE	RECHECK TORQUE
DISC BRAKE CALIPER-TO STEERING KNUCKLE BOLT	95 N·m (70 FT-LBS)	85-105 N·m (63-77 FT-LBS)
FRONT WHEEL BEARING-TO-SUSPENSION KNUCKLE BOLT	15 N·m (11 FT-LBS)	13-17 N·m (9-13 FT-LBS)
BALL JOINT AND STABILIZER BAR-TO-FRONT SUSPENSION ARM NUT	105 N·m (77 FT-LBS)	95-115 N·m (70-85 FT-LBS)
FRONT SUSPENSION ARM-TO-ENGINE CRADLE NUT	140 N·m (103 FT-LBS)	125-155 N·m (92-114 FT-LBS)
BALL-JOINT STUD-TO-SUSPENSION KNUCKLE NUT	82 N·m (60 FT-LBS)	74-90 N·m (55-66 FT-LBS)
STRUT STUD-TO-TOWER CUSHION LOCK NUT	70 N·m (52 FT-LBS)	70-80 N·m (48-55 FT-LBS)
TOWER CUSHION-TO-STRUT BODY NUT	23 N·m (17 FT-LBS)	20-26 N·m (15-19 FT-LBS)
STRUT BODY-TO-SUSPENSION KNUCKLE NUT	167 N·m (123 FT-LBS)	146-188 N·m (108-138 FT-LBS)
STABILIZER BAR-TO-CRADLE BRACKET BOLT	28 N·m (21 FT-LBS)	26-31 N·m (19-23 FT-LBS)
TIE-ROD END STUD-TO-BRACKET NUT	37 N·m (27 FT-LBS)	32-42 N·m (23-31 FT-LBS)
FRONT DRIVE SHAFT NUT	245 N·m (181 FT-LBS)	225-265 N·m (166-195 FT-LBS)
REAR SHOCK ABSORBER UPPER BOLT LOWER BOLT	 82 N·m (60 FT-LBS) 115 N·m (85 FT-LBS)	 70-93 N·m (52-67 FT-LBS) 99-131 N·m (73-97 FT-LBS)
TORSION SUPPORT BRACKET BOLT	92 N·m (68 FT-LBS)	79-105 N·m (59-77 FT-LBS)
WHEEL LUG NUT	85 N·m (63 FT-LBS)	73-97 N·m (54-72 FT-LBS)
REAR BRAKE BACKING PLATE BOLT	16 N·m (12 FT-LBS)	14-18 N·m (10-14 FT-LBS)
STUB-AXLE SHAFT-TO-WHEEL HUB LOCKNUT	167 N·m (123 FT-LBS)	153-191 N·m (105-141 FT-LBS)

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BRAKES

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GENERAL INFORMATION

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BRAKE SYSTEM COMPONENTS

The brake system features four-wheel disc or front disc/rear drum brake assemblies depending on model. All models also use a proportioning valve, a dual circuit cartridge-type master cylinder and a vacuum operated dual diaphragm power brake booster.

All models whether four-wheel disc or front disc/rear drum vehicles use the same single piston slider-type front caliper. All front rotors are vented. The rear rotors are solid (not vented).

The rear caliper (four-wheel disc models) are also single piston slider-type, but with a unique dual function. They serve as the normal wheel brake units and as the vehicle parking brakes. The rear drum brakes are internal expanding, servo-type units. The disc brake rotors and rear brake drums are made from composite materials.

The parking brake mechanism is cable operated. The cables are attached to actuating levers on the rear drum brake trailing shoes or rear disc brake actuating lever. The cables are operated by a foot pedal assembly mounted on the driver's side kick panel.

BRAKE LINING MATERIAL

The front and rear brake lining on Premier models is made from an organic material. The brake linings do not contain asbestos in any form.

The disc brake lining material is bonded to the brake shoes. The disc brake lining is a semi-metallic type with metal fibers interspersed throughout the lining material. The rear drum brake lining is riveted to the shoes.

BRAKE FLUID

The only brake fluid recommended for use in the Premier brake system is Mopar brake fluid, or an equivalent fluid meeting DOT and SAE standards J1703 and DOT 3.

Use new brake fluid only, to top off the master cylinder or refill the system. Never use reclaimed fluid, fluid not meeting the SAE/DOT standards, or fluid from a container that has been left open for any length of time.

COMPONENT SERVICEABILITY AND ADJUSMENTS

Component Serviceability

The front and rear wheel brake components, (except Caliper housings and pistons) the brake lines and the wheel cylinders are serviceable components.

The master cylinder, power brake booster and proportioning valve are not repairable. These components must be replaced if diagnosis indicates a malfunction.

The only serviceable components on the rear disc brake assembly are the brakeshoes, operating lever, lever return spring and the slider pins, bushings and boots. The rear calipers are not serviceable and must be replaced if diagnosis reveals a problem.

The front disc brake caliper bores must not be honed. The calipers must be replaced if the bores are worn oversize, scored, or severely corroded or pitted.

The disc brake rotors and the rear brake drums can be machined on a lathe to restore surface finish. However, if a rotor or drum is distorted, damaged, or worn beyond allowable limits, the rotor or drum must be replaced.

The wheel cylinder bores must not be honed. The cylinders must be replaced if the bores are worn oversize, scored, or severely corroded or pitted.

Brake Adjustments

The front parking brake cable and rear drum brakes are the only adjustable components in the brake system. Refer to the Service Adjustments section in this group.

Rear Brake Lubricant

When servicing rear drum brakes, use Mopar rear brake lubricant, molydisulphine grease, or chassis grease to lubricate the drum brakeshoe pivot pins and shoe contact points on the backing plates.

Brake Cleaning Solvent

Use clean brake fluid or Mopar brake cleaner to clean or flush brake system components. These are the only cleaning materials recommended.

CAUTION: Never use gasoline, kerosene, alcohol, motor oil, transmission fluid, or any fluid containing mineral oil to clean brake system components. These fluids damage rubber cups and seals. If system contamination is suspected, check the fluid for dirt, discoloration, or separation into distinct layers. Drain and flush the system with new brake fluid if contamination is suspected.

SERVICE DIAGNOSIS

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DIAGNOSIS PROCEDURES

Brake diagnosis involves determining if the problem is related to a mechanical, hydraulic or vacuum operated component. A preliminary check, road testing and component inspection can all be used to determine a problem cause.

Road testing will either verify proper brake operation or confirm the existence of a problem. Component inspection will, in most cases, identify the actual part causing a problem.

The first diagnosis step is the preliminary check. This involves inspecting fluid level, parking brake action, wheel/tire condition, checking for obvious leaks or component damage and testing brake pedal response. A road test should confirm or deny the existence of a problem. The final diagnosis procedure involves road test analysis and a visual inspection of brake components.

Preliminary Brake Check

(1) Check condition of tires and wheels. Damaged wheels and worn, damaged, or underinflated tires can cause pull, shudder, tramp, and a condition similar to grab.

(2) If complaint was based on noise when braking, check suspension components. Jounce front and rear of vehicle and listen for noise that might be caused by loose, worn or damaged suspension or steering components.

(3) Inspect brake fluid level and condition.

(a) If fluid level is abnormally low, look for evidence of leaks at calipers, wheel cylinders, brakelines and master cylinder.

(b) If fluid appears contaminated, drain out a sample. If fluid is separated into layers, or obviously contains oil or a substance other than brake fluid, the system seals and cups will have to be replaced and the hydraulic system flushed.

(4) Check parking brake operation. Verify free movement and full release of cables and foot pedal. Also note if vehicle was being operated with parking brake partially applied.

(5) Check brake pedal operation. Verify that pedal does not bind and has adequate free play. If pedal lacks free play, check pedal and power booster for being loose or for bind condition. Do not road test until condition is corrected.

(6) If components checked appear OK, road test the vehicle.

Road Testing

(1) If (vehicle is equipped with rear drum brakes and) complaint involved low brake pedal, make 10-12 forward and reverse stops to equalize rear drum brake adjustment. Alternate stops (one forward-one reverse) and make complete stops.

(2) Check brake pedal response with transmission in Neutral and engine running. Pedal should remain firm under steady foot pressure.

(3) During road test, make normal and firm brake stops in 25-40 mph range. Note faulty brake operation such as pull, grab, drag, noise, low pedal, hard pedal, fade, pedal pulsation, etc.

(4) Inspect suspect brake components and refer to problem diagnosis information for causes of various brake conditions.

Component Inspection

Fluid leak points and dragging brake units can usually be located without removing any components. The area around a leak point will usually be wet with fluid. The components at a dragging brake unit (wheel, tire, rotor/drum) will usually be quite warm or hot to the touch.

Other brake problem conditions will require component removal for proper inspection. Raise the vehicle and remove the wheel and tire assemblies. Then remove the calipers and brake drums for better visual access. Then refer to the problem diagnosis section.

DIAGNOSING BRAKE PROBLEMS

Pedal Falls Away

A brake pedal that falls away under steady foot pressure is generally the result of a system leak. The leak point could be at a brakeline, fitting, hose, caliper, or wheel cylinder. Internal leakage in the master cylinder (fluid leaks by worn or damaged piston cups) could also be the problem cause.

If leakage is severe, fluid will be evident at or around the leaking component. However internal leakage in the master cylinder will not be physically evident. Refer to the cylinder test procedure in this section.

Low Pedal

If a low pedal is experienced, pump the pedal several times. If the pedal comes back up, worn lining and worn rotors/drums are the most likely causes.

A low master cylinder fluid level usually accompanies a low pedal condition. It is a result of the normal outward movement of caliper and wheel cylinder pistons to compensate for lining wear.

Spongy Pedal

A spongy pedal is most often caused by air in the system. Thin rear brake drums or substandard brake lines and hoses can also cause a spongy pedal.

CAUTION: The rear wheels must be at normal ride height for satisfactory wheel cylinder bleeding. Air can be trapped in the wheel cylinders or calipers if the rear wheels are at full rebound position. Position the vehicle on a drive-on hoist or raise the rear wheels to normal ride height before bleeding.

Hard Pedal/High Pedal Effort

A hard pedal or high pedal effort may be due to lining that is water soaked, contaminated, glazed, or badly worn. The power booster or check valve could also be faulty. Test the booster and valve as described in this seciton.

Brake Drag

Brake drag occurs when the lining is in constant contact with the rotor or drum. Drag can occur at one wheel, all wheels, fronts only, or rears only. It is a product of incomplete brakeshoe release. Drag can be minor or severe enough to overheat the linings, rotors and drums.

Brake drag also has a direct effect on fuel economy. If undetected, minor brake drag can be misdiagnosed as an engine or transmission/torque converter problem.

Minor drag will usually cause slight surface charring of the lining. It can also generate hard spots in rotors and drums from the overheat-cool down process. In most cases, the rotors, drums, wheels and tires are quite warm to the touch after the vehicle is stopped.

Severe drag can char the brake lining all the way through. It can also distort and score rotors and drums to the point of replacement. The wheels, tires and brake components will be extremely hot. In severe cases, the lining may generate smoke as it chars from overheating.

Some common causes of disc brake drag are: loose, damaged wheel bearing, seized or sticking caliper piston, caliper binding on corroded slide pins, loose caliper mounting bracket, or misassembled components.

Some common causes of rear drum brake drag are: park brake cables binding (do not release), misadjusted brakeshoes, shoes reversed, adjuster screws installed on wrong side or in reverse position, weak or broken shoe springs, shoes not chamfered or incorrectly arced, warped backing plate, stuck wheel cylinder piston, or bent brakeshoes.

If brake drag occurs at all wheels, the problem may be related to a blocked master cylinder return port or faulty power booster (binds, does not release).

Brake Fade

Brake fade is a product of overheating caused by brake drag. However, brake overheating and subsequent fade can also be caused by riding the brake pedal, making repeated high deceleration stops in a short time span, or constant braking on steep mountain roads. Refer to the Brake Drag information in this section for causes of brake drag.

Pedal Pulsation

Pedal pulsation is caused by components that are loose, or beyond tolerance limits.

Disc brake rotors with excessive lateral runout or thickness variation and out-of-round brake drums are the primary causes of pulsation. Other causes are loose wheel bearings, calipers/drums and worn, damaged tires.

Pull

A front pull condition could be the result of contaminated lining in one caliper, seized caliper piston, binding caliper, loose caliper bracket, loose or corroded slide pins, improper brakeshoes, or a damaged rotor.

A worn, damaged wheel bearing or suspension component are further causes of pull. A damaged front tire (bruised, ply separation) can also cause pull.

Rear pull is generally a result of lining contamination or drag at one wheel. The drag could be due to brakeshoe misadjustment, incorrectly assembled parts, or damaged/worn parts.

A common (and frequently misdiagnosed) pull condition is where direction of pull changes after a few stops. The cause is a combination of brake drag followed by fade at one of the brake units.

As the dragging brake overheats, efficiency is so reduced that fade occurs. Since the opposite brake unit is still functioning normally, its braking effect is magnified. This causes pull to switch direction in favor of the normally functioning brake unit.

When diagnosing a change in pull condition, remember that pull will return to the original direction if the dragging brake unit is allowed to cool down (and is not seriously damaged).

Rear Brake Grab

Rear drum brakes that grab and/or pull, are usually caused by linings that are contaminated, or by misadjusted or improperly assembled components. This is particularly true when only one rear wheel is involved. However, when both rear wheels are affected, the proportioning valve could be at fault. If necessary test the valve as described in this section.

Brakes Do Not Hold After Driving Through Deep Water Puddles

This condition is generally caused by water soaked lining. If the lining is only wet, it can be dried by driving with the brakes lightly applied. However, if the lining is both wet and dirty, disassembly and cleaning will also be necessary.

The rear backing plates should be checked for missing access plugs and gaps between the plate and axle hub. Either condition will allow water into the rear brake units.

Brake Noise

Squeak/Squeal

Brake squeak or squeal may be due to linings that are wet or contaminated with brake fluid, grease, or oil. Glazed linings and rotors/drums with hard spots can also contribute to squeak. Dirt and foreign material embedded in the brake lining can also cause squeak/squeal.

A very loud squeak or squeal is frequently a sign of severely worn brake lining. If the lining has worn through to the brakeshoes in spots, metal-to-metal contact occurs. If the condition is allowed to continue, rotors and drums can become so scored that replacement is necessary.

Thump/Clunk

Thumping or clunk noises during braking are frequently not caused by brake components. In many cases, such noises are caused by loose or damaged steering, suspension, or engine components. However, calipers that bind on the slide pins can generate a thump or clunk noise. In addition, worn out, improperly adjusted, or improperly assembled rear brakeshoes can also produce a thump noise.

Shoe Click Or Snap

Click or snap noises are primarily confined to rear drum brakes. The cause is brakeshoe cocking and occurs as the shoe snaps back into position after brake release. A warped packing plate will also cause click or snap by placing the shoe in a cocked position.

Brakeshoes that are bent, or not chamfered will also cause click or snap noise. Such brakeshoes can also cause drag and grab.

Chatter

Brake chatter is usually caused by loose or worn components, glazed or burnt lining. Rotors and drums with hard spots can also contribute to chatter.

Additional causes of chatter are out-of-tolerance drums/rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.

Brakelining Contamination

Brakelining contamination is usually a product of leaking calipers or wheel cylinders, driving through deep water puddles, or lining that has become covered with grease and grit during repair.

Wheel and Tire Problems

Some conditions attributed to brake components may actually be caused by a wheel or tire problem.

A damaged wheel can cause shudder, vibration and pull. A worn or damaged tire can also cause pull.

Severely worn tires with very little tread left can produce a grab-like condition as the tire loses and recovers traction.

Flat-spotted tires can cause vibration and wheel tramp and generate shudder during brake operation.

A tire with internal damage such as a severe bruise or ply separation can cause pull and vibration.

PROPORTIONING VALVE PRESSURE TEST

The proportioning valve regulates brake fluid pressure to the rear drum or disc brake wheel cylinders. The valve is not repairable and must be replaced if faulty.

Proportioning valve testing requires two pressure gauge tools 7212 (Fig. 1). Gauge capacity must be a minimum of 1200 psi. The gauges must also have provisions for gauge bleeding.

The hydraulic system is connected in a diagonal pattern. The proportioning valve connections are: right front to left rear and left front to right rear (Figs. 2 and 3). Valve testing must be performed in the correct diagonal pattern for accurate results.

Proportioning Valve Test Procedure

(1) Remove the bleed screws from the right front caliper and left rear wheel cylinder or caliper.

(2) Install a pressure gauge 7212 in each caliper and/or wheel cylinder in place of the bleed screws (Fig. 2).

(3) Bleed air out through the gauge bleed valves.

(4) Start the engine.

(5) Observe and record the gauge readings while a helper applies pressure to the brake pedal.

(6) Stop the engine.

(7) Remove the pressure gauges and reinstall the bleed screws.

(8) Remove the bleed screws from the left front caliper and right rear wheel cylinder or caliper and install gauges (Fig. 3).

(9) Bleed air from gauges.

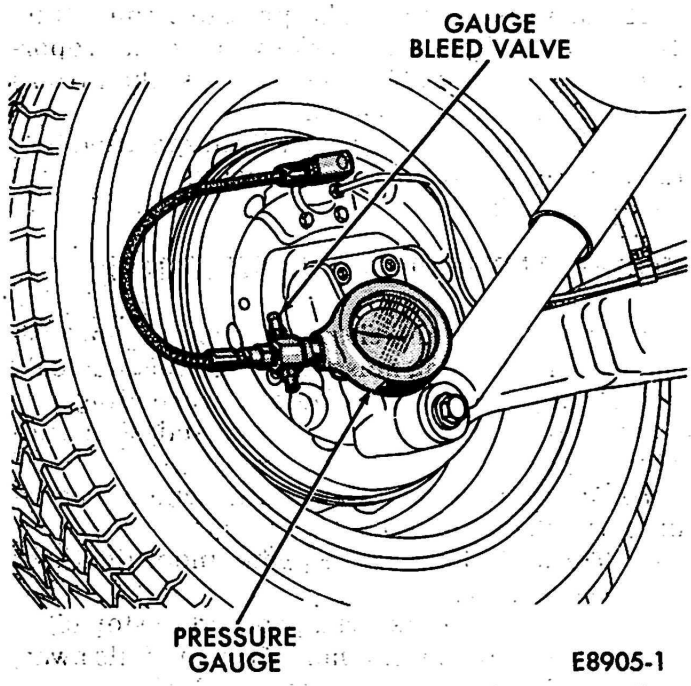


Fig. 1—Pressure Test Gauge Connection (Typical)

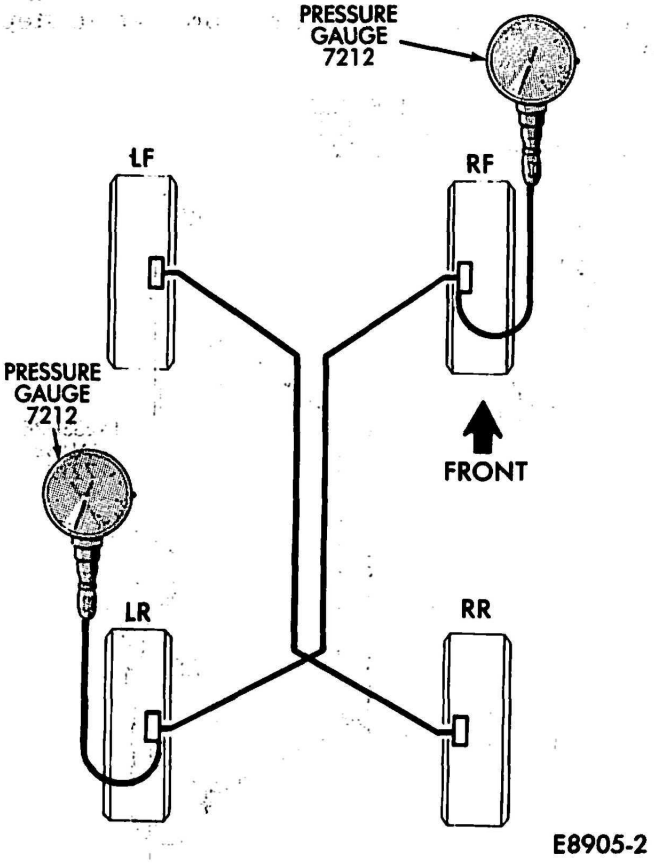


Fig. 2—Left Front-Right Rear Pressure Test

(10) Observe and record gauge readings while helper applies pressure to brake pedal.

(11) Remove gauges and reinstall bleed screws.

(12) See disc/drum brake pressure chart (Fig. 4). For four wheel disc brake vehicles a proportional pressure of .37 (lower rear psi than front) occurs at and above 430 psi.

(a) If gauge readings are within specified limits, valve is OK. If not, replace valve.

(13) Bleed brakes.

MASTER CYLINDER/POWER BOOSTER TEST

(1) Start engine and check booster vacuum hose connections. Hissing noise indicates vacuum leak. Correct any vacuum leak before proceeding.

(2) Stop engine and shift transmission into Neutral.

(3) Pump brake pedal until all vacuum reserve in booster is depleted.

(4) Press and hold brake pedal under light foot pressure.

(a) If pedal holds firm, proceed to step (5).

(b) If pedal does not hold firm and falls away, master cylinder is faulty (internal leakage).

(5) Start engine and note pedal action.

(a) If pedal falls away slightly under light foot pressure then holds firm, proceed to step (6).

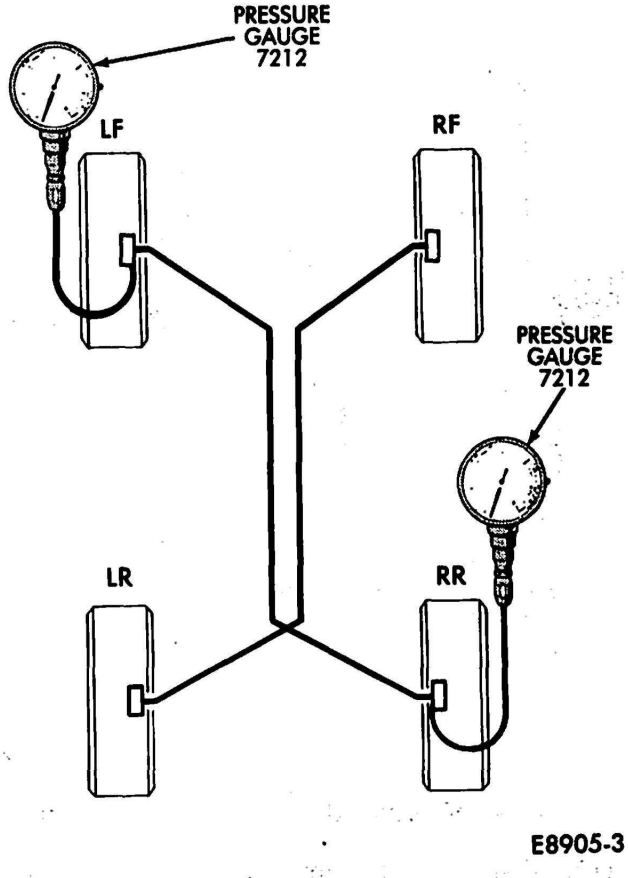


Fig. 3—Right Front-Left Rear Pressure Test

Pressure Chart	
When Front Gauge Reading is:	Rear Gauge Reading Should Be:
(P.S.I.)	(P.S.I.)
0	0
100	100
200	200
275	250-300
400	288-354
600	358-432
800	432-507
1000	493-593
1200	557-677

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Fig. 4—Proportioning Valve Pressure Chart

(b) If no pedal action is discernible, power booster or vacuum check valve is faulty. Install known good check valve and repeat steps (2) through (5).

(6) Rebuild booster vacuum reserve as follows: Release brake pedal. Increase engine speed to 1500 rpm, close the throttle and immediately turn off ignition.

(7) Wait a minimum of 90 seconds and try brake action again. Booster should provide two or more vacuum assisted pedal applications. If vacuum assist is not provided, perform booster and check valve vacuum tests.

POWER BOOSTER CHECK VALVE TEST

(1) Disconnect the vacuum hose from check valve.

(2) Remove check valve and valve seal from booster (Fig. 5).

(3) Hand operated vacuum pump can be used for test (Fig. 6).

(4) Apply 15-20 inches vacuum at large end of check valve (Fig. 5).

(5) Vacuum should hold steady. If gauge on pump indicates any vacuum loss, valve is faulty and must be replaced.

POWER BOOSTER VACUUM TEST

(1) Connect a vacuum gauge to the booster check valve with a short length of hose and a T-fitting (Fig. 7).

(2) Start and run the engine at idle speed for one minute.

(3) Clamp the hose from the vacuum source to the check valve (Fig. 7).

(4) Stop the engine and observe the vacuum gauge.

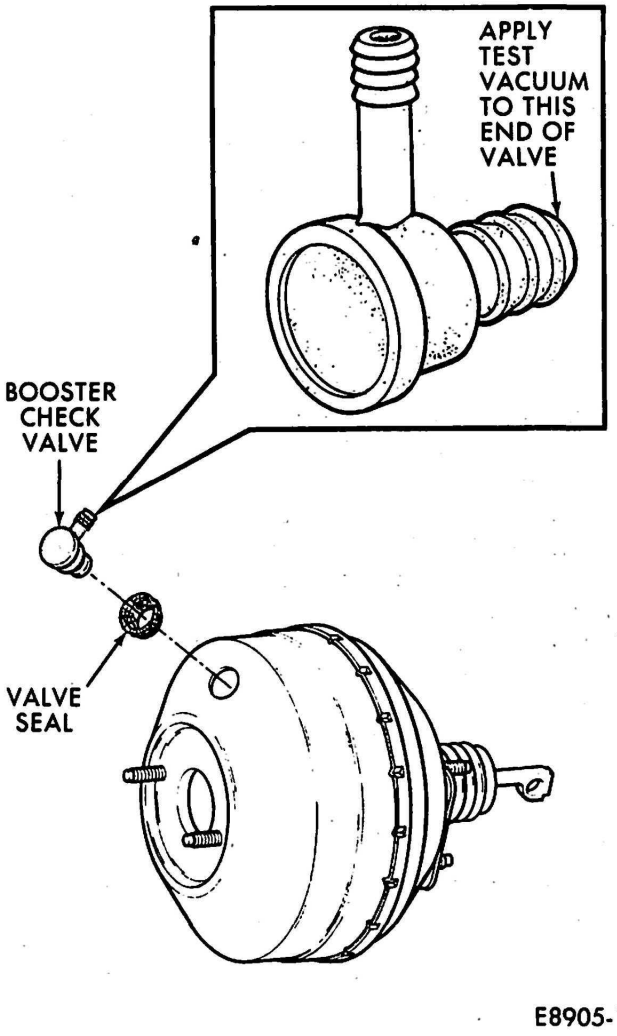


Fig. 5—Vacuum Check Valve and Seal

(5) If vacuum drops more than one inch HG (33 millibars) within 15 seconds, either the booster diaphragm or check valve are faulty.

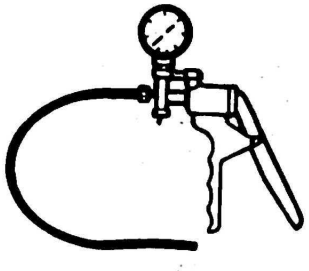


Fig. 6—Hand Operated Vacuum Pump (Typical)

BRAKE BLEEDING INFORMATION

The rear suspension on Premier models provides exceptional jounce rebound travel for improved ride and handling. When bleeding Premier brakes, suspension rebound travel must be taken into consideration.

The rear wheels on Premier models must be at normal ride height for satisfactory rear wheel cylinder bleeding. Air can be trapped in the wheel cylinders if the rear wheels are at full rebound position. Position the vehicle on a drive-on hoist or raise the rear wheels to normal ride height before bleeding.

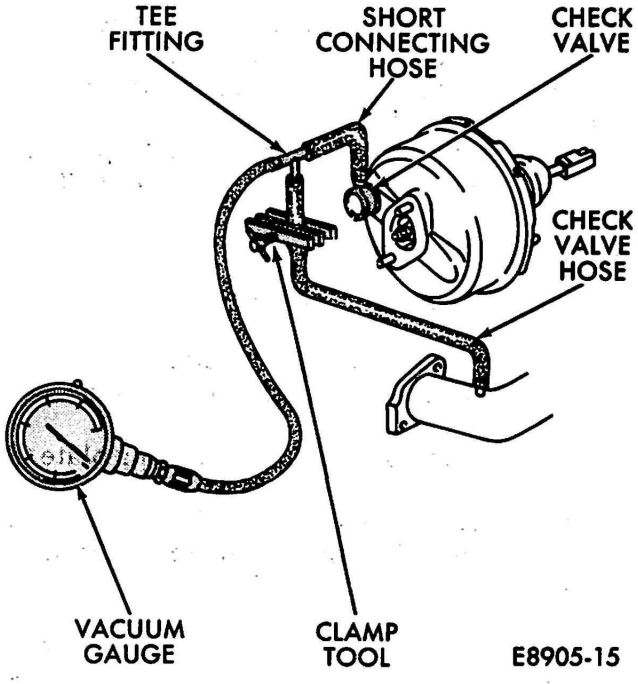


Fig. 7—Booster Vacuum Test Connections

SERVICE ADJUSTMENT

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BRAKE FLUID LEVEL

(1) Clean reservoir filler cap and top of reservoir thoroughly. This is necessary to prevent dirt from falling into reservoir when filler cap is removed.

(2) Remove filler cap.

(3) Correct fluid level is to bottom edge of reservoir filler neck.

(4) If fluid level is only sightly low, normal brake lining wear is indicated. However, if fluid level is extremely low, fill reservoir and check for leaks or worn brakelining.

(5) Add fluid if necessary. Use Mopar brake fluid or an equivalent meeting SAE J1703 and DOT 3 standards.

(6) Install filler cap.

REAR BRAKESHOE ADJUSTMENT

Adjustment-Without Brake Gauge

(1) Raise rear of vehicle and remove rear wheels.

(2) Remove access plug from backing plate (Fig. 1).

(3) Working through access plug hole, tighten adjuster screw with brake tool until drum is at moderate drag condition (Fig. 2).

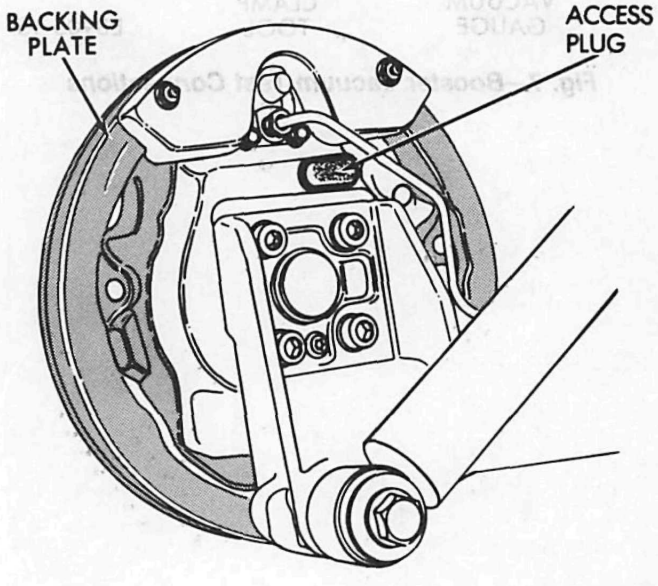


Fig. 1—Access Plug Location

(4) Hold adjuster lever away from adjuster screw with thin blade screwdriver (Fig. 3).

(5) Back off adjuster screw one full turn with brake tool (Fig. 3).

(6) Install access plug in backing plate (Fig. 1).

(7) Install wheel and lower vehicle.

Adjustment-With Brake Gauge

(1) Raise rear of vehicle.

(2) Remove wheel and brake drum.

(3) Set brake gauge (Fig. 4) to diameter of braking surface of brake drum. Tighten gauge clamp screw to lock gauge in position.

(4) Place brake gauge on brakelining.

(5) Unseat adjuster lever. Then turn adjuster screw until shoes are adjusted to brake gauge (Fig. 4).

(6) Install brake drum and wheel.

(7) Lower vehicle.

PARKING BRAKE ADJUSTMENT

(1) Verify correct rear drum brake adjustment. Adjust rear brakes if necessary.

(2) If rear brakeshoes have just been replaced, apply and release the parking brake five times to center shoes in drums.

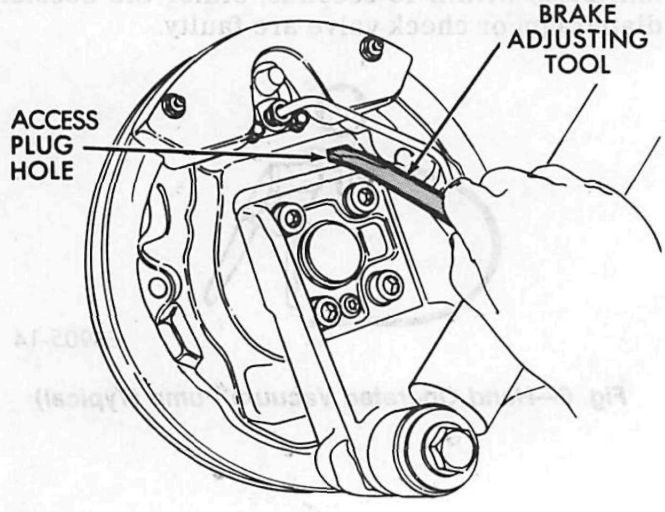


Fig. 2—Tightening Adjuster Screw

(3) Press parking brake pedal down to first detent. Only one click should be heard as pedal assembly reaches first detent.

(4) Raise vehicle.

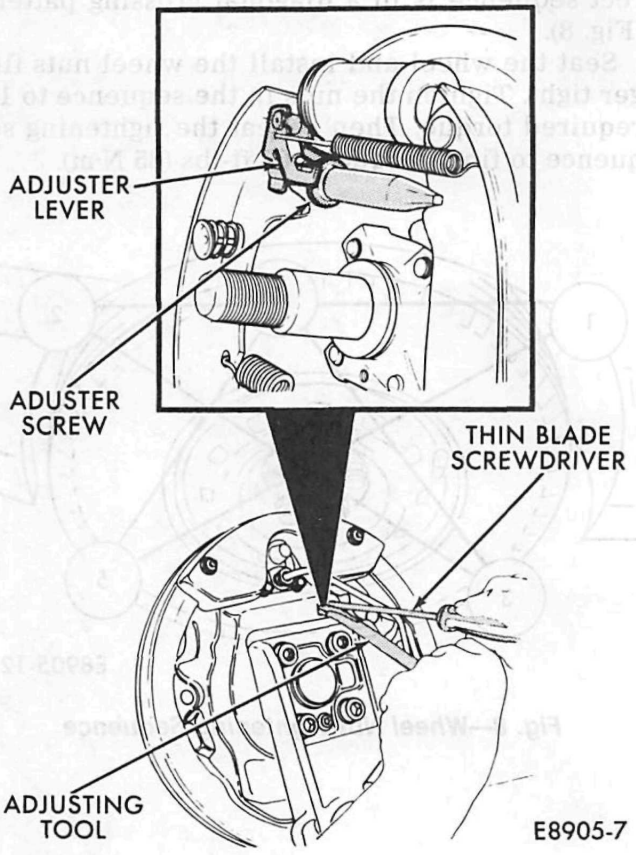


Fig. 3—Backing Off Adjuster Screw

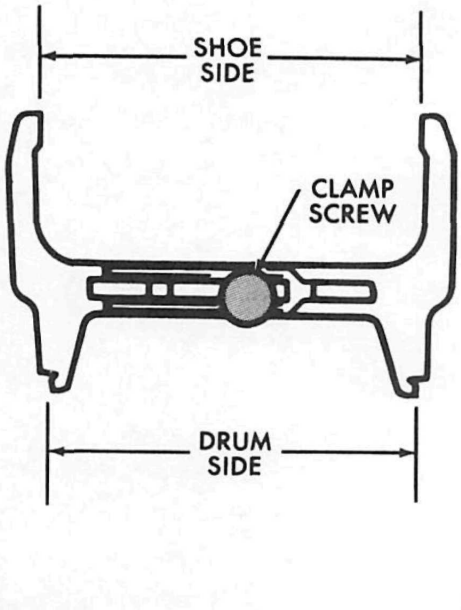


Fig. 4—Standard Brake Gauge (Typical)

(5) Assemble inch-pound torque wrench and parking brake tension gauge 80002 543 (Fig. 5).

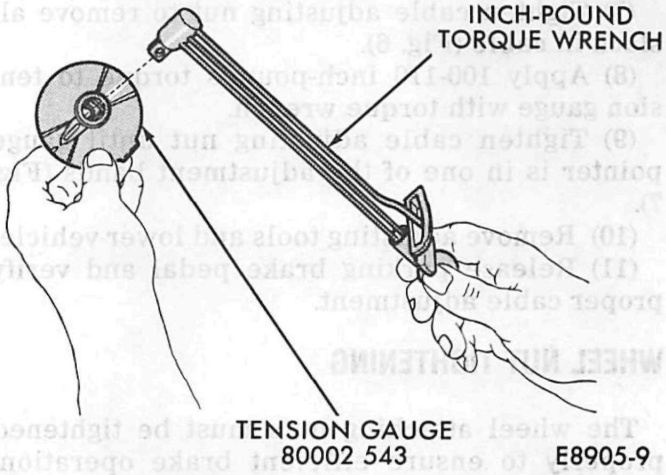


Fig. 5—Assembling Torque Wrench And Gauge

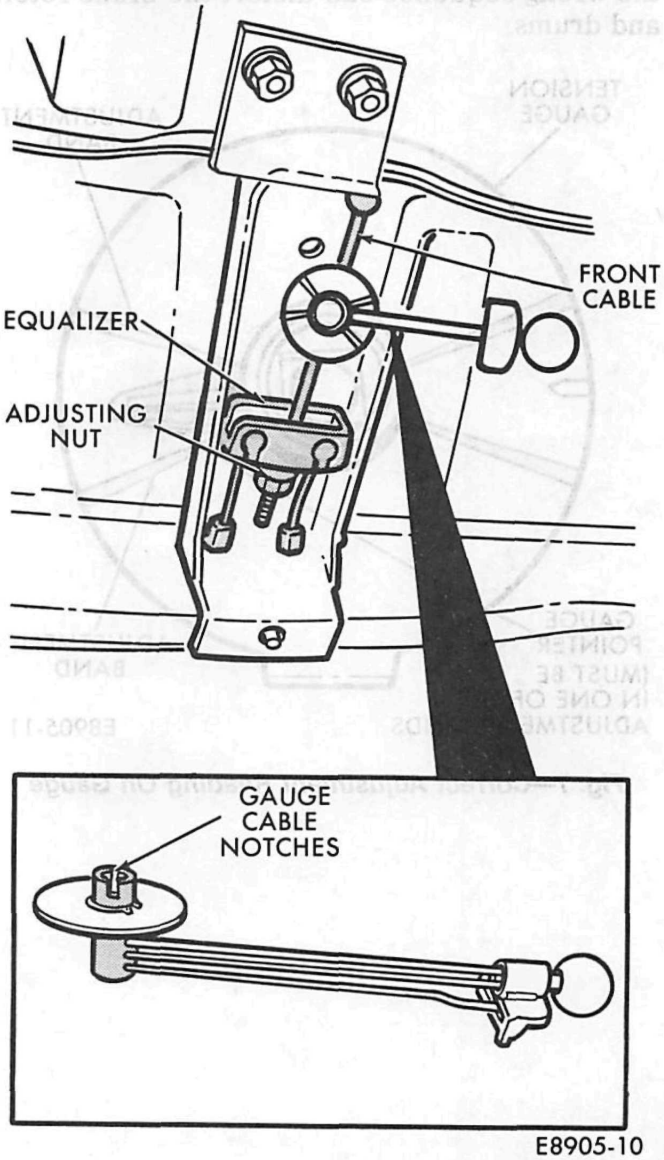


Fig. 6—Parking Brake Cable Adjustment

(6) Place gauge on front cable. Position gauge at cable midpoint and be sure cable is seated in both notches of tension gauge (Fig. 6).

(7) Tighten cable adjusting nut to remove all slack in cable (Fig. 6).

(8) Apply 100-110 inch-pounds torque to tension gauge with torque wrench.

(9) Tighten cable adjusting nut until gauge pointer is in one of the adjustment bands (Fig. 7).

(10) Remove adjusting tools and lower vehicle.

(11) Release parking brake pedal and verify proper cable adjustment.

WHEEL NUT TIGHTENING

The wheel attaching nuts must be tightened properly to ensure efficient brake operation. Overtightening the nuts or tightening them in the wrong sequence can distort the brake rotors and drums.

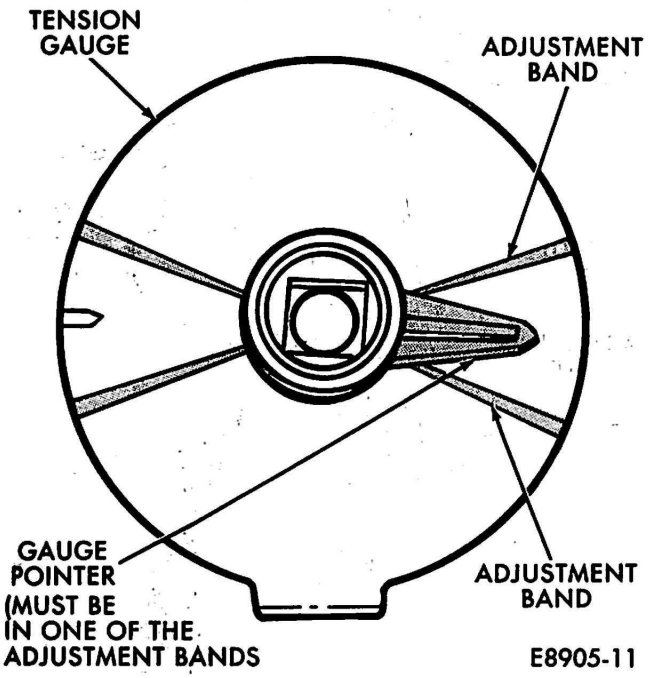


Fig. 7—Correct Adjustment Reading On Gauge

Impact wrenches are not recommended for tightening wheel nuts. A torque wrench should be used for this purpose.

The correct tightening sequence is important in avoiding rotor and drum distortion. The correct sequence is in a diagonal crossing pattern (Fig. 8).

Seat the wheel and install the wheel nuts finger tight. Tighten the nuts in the sequence to 1/2 required torque. Then repeat the tightening sequence to final torque of 63 ft-lbs (85 N·m).

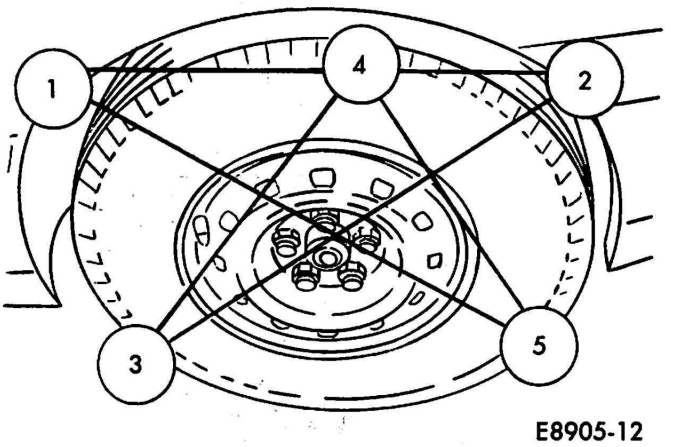


Fig. 8—Wheel Nut Tightening Sequence

BRAKE HYDRAULIC SYSTEM

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CHECKING BRAKE FLUID LEVEL

(1) Clean reservoir filler cap and top of reservoir thoroughly. This is necessary to prevent dirt from falling into reservoir when the filler cap is removed.

(2) Remove filler cap.

(3) Correct fluid level is to bottom edge of reservoir filler neck.

(4) If fluid level is only slightly low, normal brake lining wear is indicated. However, if fluid level is extremely low, fill reservoir and check for leaks or severe worn breaklining.

(5) Add fluid if necessary. Use Mopar brake fluid or an equivalent meeting SAE J1703 and DOT 3 standards.

(6) Install filler cap.

MASTER CYLINDER REMOVAL

(1) Place cloth under master cylinder to absorb brake fluid.

(2) Disconnect fluid level switch connector at reservoir (Fig. 1).

(3) Loosen brakelines at top of proportioning valve (Fig. 1).

(4) Disconnect brakelines from master cylinder (Fig. 1).

(5) Remove nuts attaching master cylinder to booster (Fig. 1).

(6) Remove proportioning valve bracket (Fig. 1).

(7) Remove master cylinder.

MASTER CYLINDER INSTALLATION

(1) Position master cylinder on booster mounting studs and seat cylinder on booster (Fig. 2).

CAUTION: Be sure the booster push rod is seated in the master cylinder primary piston before seating the cylinder on the booster. Also take care to avoid damaging the primary piston surface during installation. Internal leakage will occur if the piston surface is scratched or scraped.

(2) Install proportioning valve bracket on master cylinder and mounting studs (Fig. 1).

(3) Connect and tighten brakelines to master cylinder and proportioning valve.

(4) Install and tighten the master cylinder attaching nuts (Fig. 1).

(5) Connect the fluid level switch connector (Fig. 1).

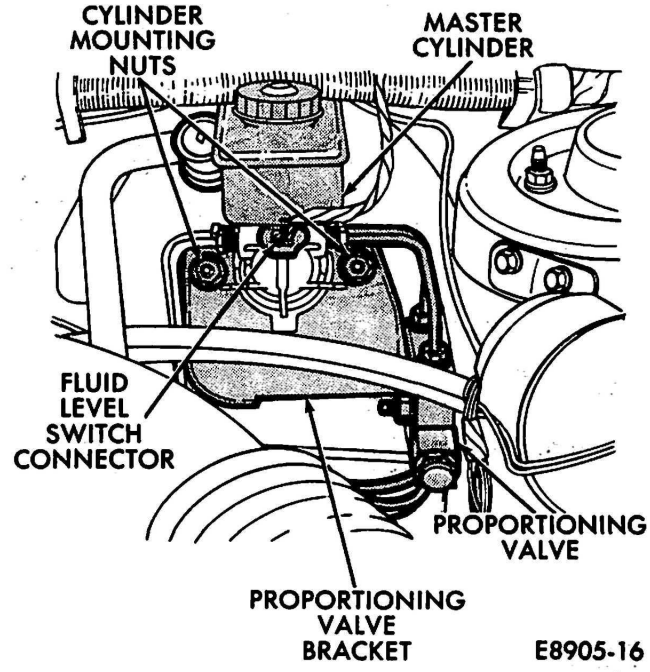


Fig. 1—Master Cylinder Mounting

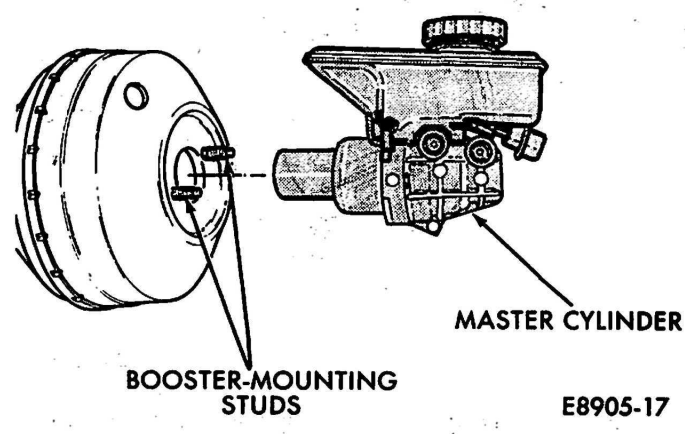


Fig. 2—Installing Master Cylinder On Booster

(6) Fill the master cylinder and bleed the brakes.

WHEEL CYLINDER REMOVAL

(1) Raise and support rear of vehicle.
(2) Remove wheel and tire.
(3) Remove brake drum retaining nuts (Fig. 3). and remove brake drum.

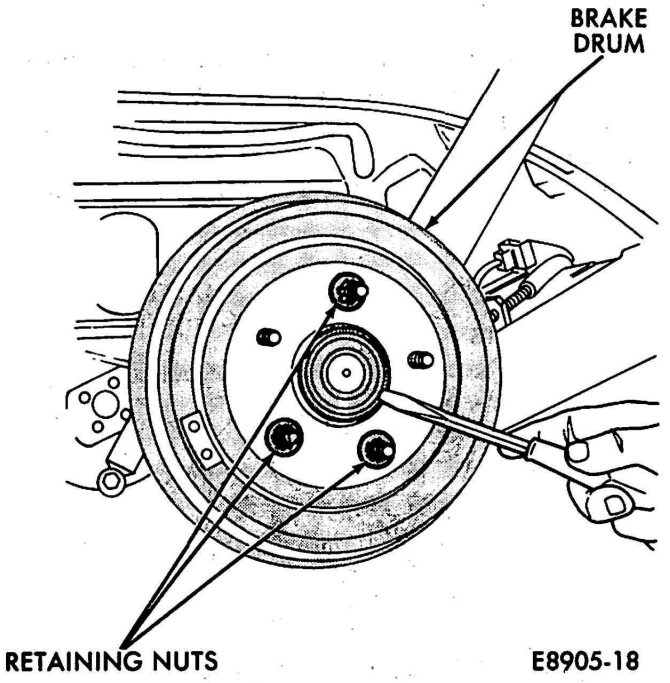


Fig. 3—Removing/Installing Brake Drum Retaining Nuts

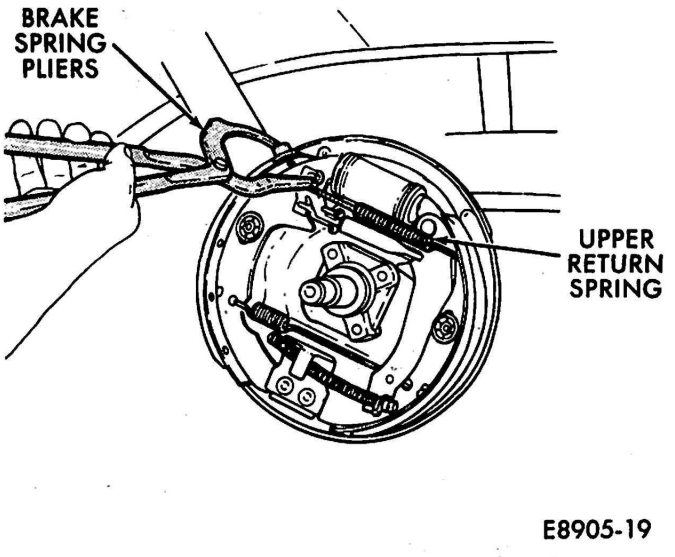


Fig. 4—Removing/Installing Upper Return Spring

(4) Remove brakeshoe upper return spring (Fig. 4).
(5) Spread brakeshoes slightly to make room for cylinder removal.
(6) Disconnect brakeline at cylinder (Fig. 5).
(7) Remove cylinder attaching bolts (Fig. 5).
(8) Remove cylinder from backing plate.

WHEEL CYLINDER OVERHAUL

(1) Remove cylinder dust covers and bleed screw (Fig. 6).

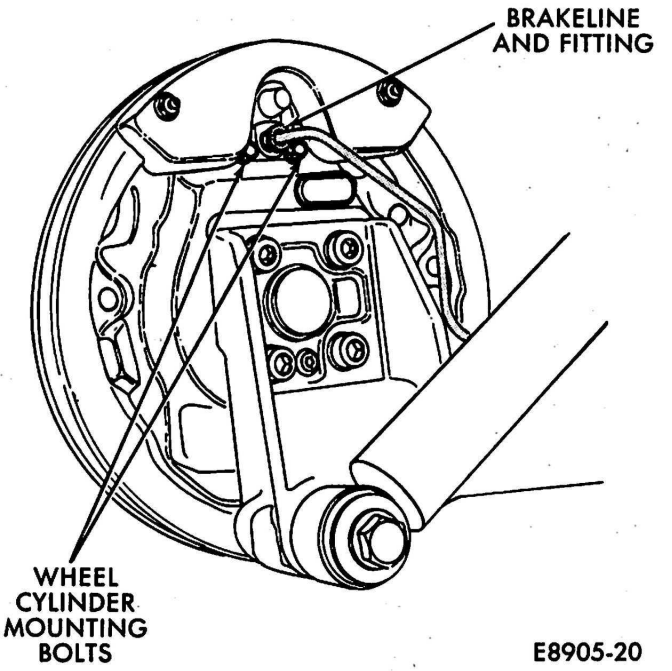


Fig. 5—Wheel Cylinder Mounting

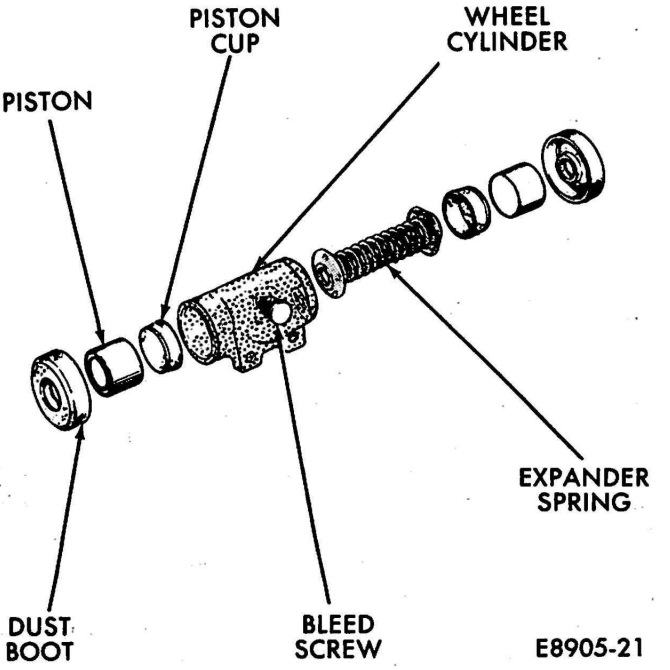


Fig. 6—Wheel Cylinder Components

(2) Remove piston cups, pistons and expander spring from cylinder bore (Fig. 6).

(3) Discard the piston cups, dust boots and expander spring. These parts are not reusable.

(4) Clean bleed fitting and cylinder with Mopar brake cleaner or clean brake fluid only. Do not use any other type of cleaning material. Dry parts with compressed air after cleaning.

(5) Inspect the cylinder bore and pistons. Light discoloration of the bore is acceptable. However, replace the cylinder as an assembly if the bore or pistons are scored, scratched, corroded, or pitted. **Do not hone the cylinder bore or sand the pistons in an attempt to restores surface finish. These components must be replaced if worn or damaged.**

(6) Lubricate cylinder bore, pistons, piston cups and expander spring with clean brake fluid.

(7) Install expander spring and piston cups in cylinder bore.

(8) Install pistons in bore and seat them against cups.

(9) Install dust boots and bleed screw.

WHEEL CYLINDER INSTALLATION

(1) Position the wheel cylinder on the backing plate and start the brakeline fitting in the cylinder.

(2) Align cylinder on backing plate and install cylinder mounting bolts.

(3) Place brakeshoes in contact with cylinder pistons and install upper return spring (Fig. 4).

(4) Check and adjust brakeshoes with brake gauge.

(5) Install brake drum. Secure drum with new retaining nuts (Fig. 3).

(6) Bleed brakes as described in this section.

(7) Install wheel and tire.

(8) Lower vehicle.

(9) Check and adjust parking brake if necessary.

PROPORTIONING VALVE REPLACEMENT

(1) Loosen all brakelines connected to proportioning valve.

(2) Loosen nuts attaching master cylinder to booster.

(3) Remove bolt and nut attaching valve to bracket (Fig. 7).

(4) Disconnect brakelines from valve and remove valve.

(5) Connect (but do not tighten) brakelines to new valve.

(6) Align valve with mounting bracket and install valve-to-bracket bolt (Fig. 7).

(7) Tighten master cylinder attaching nuts.

(8) Tighten brakelines at proportioning valve.

(9) Bleed brakes as described in this section.

BRAKELINES

A combination of brakelines and brake hoses are used front and rear. Metal lines are used from the master cylinder and proportioning valve to the wheel brake units. Brake hoses are used to connect the front brakelines to the calipers (Fig. 8). Brake hoses are used between the lines from the proportioning valve and the lines connected to the rear wheel cylinders (Fig. 9).

Metal brakelines and rubber brake hoses should be replaced when damaged or leaking. Brakeline repair is not recommended.

The front brake hoses are connected to the calipers with a fitting bolt and two seal washers (Fig. 8). Be sure the seal washers are installed as shown. Leakage will occur if one of the washers is omitted, or if the washers are mispositioned.

When connecting brakelines, lubricate the fitting threads with brake fluid and start the fittings by hand before tightening. This procedure will help avoid stripped threads and a second (unnecessary) repair.

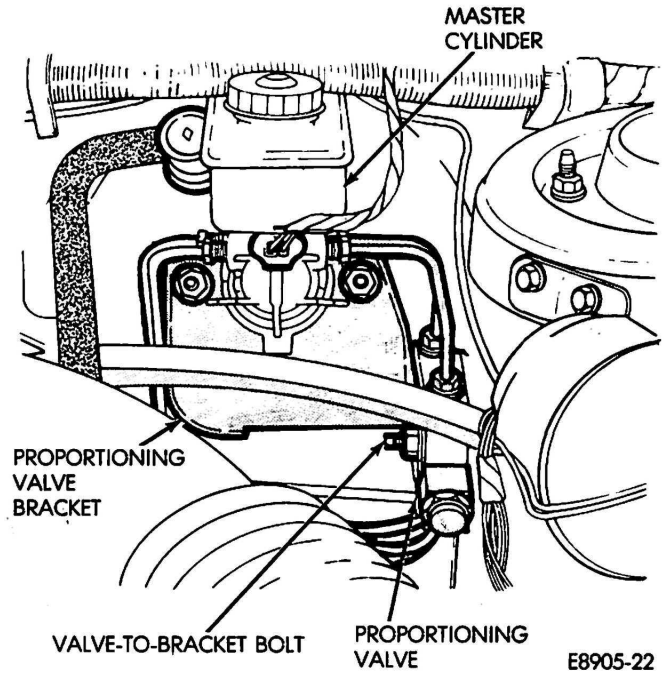


Fig. 7—Proportioning Valve Attachment

BRAKE FLUID CONTAMINATION

Brake fluid contamination is usually the result of adding improper fluids, using old/reclaimed fluid, using fluid from unsealed containers and by dirt entering the system through the reservoir filler neck. Fluid contamination can also be caused by using non-recommended cleaning materials during repair.

Oil in brake fluid will cause brake system rubber seals to soften and swell. The seals may also

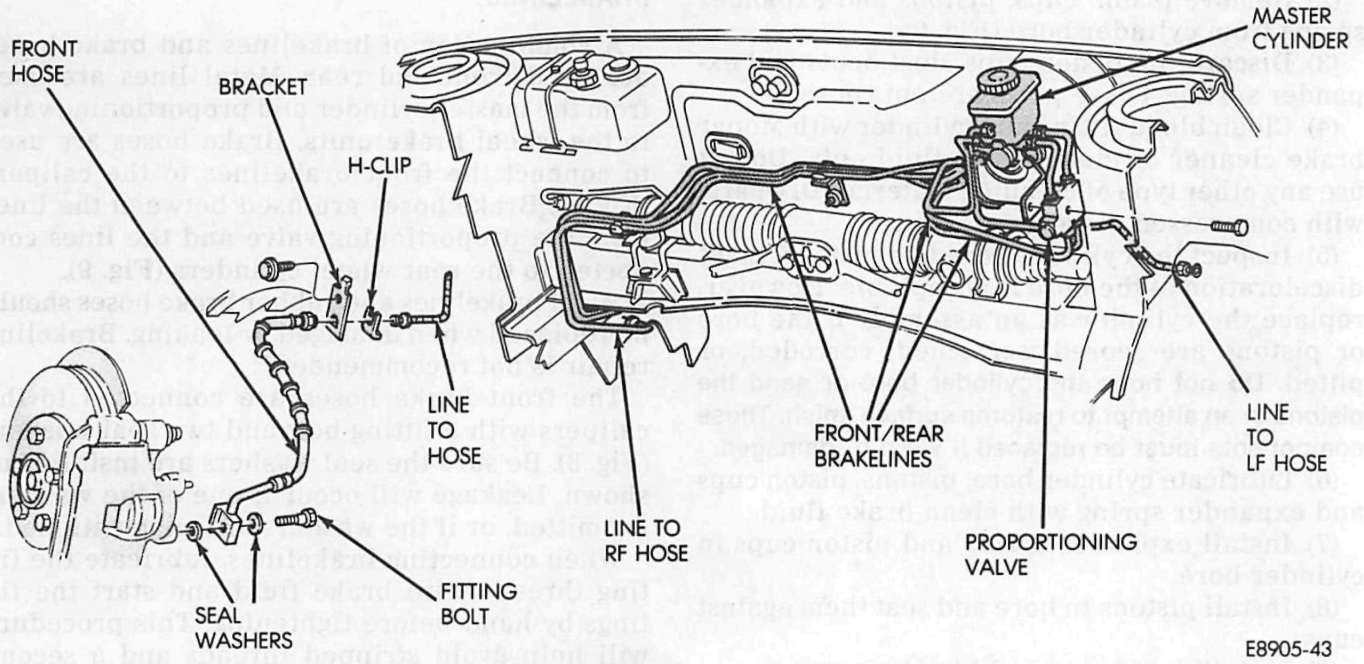


Fig. 8—Front Brakeline Routing

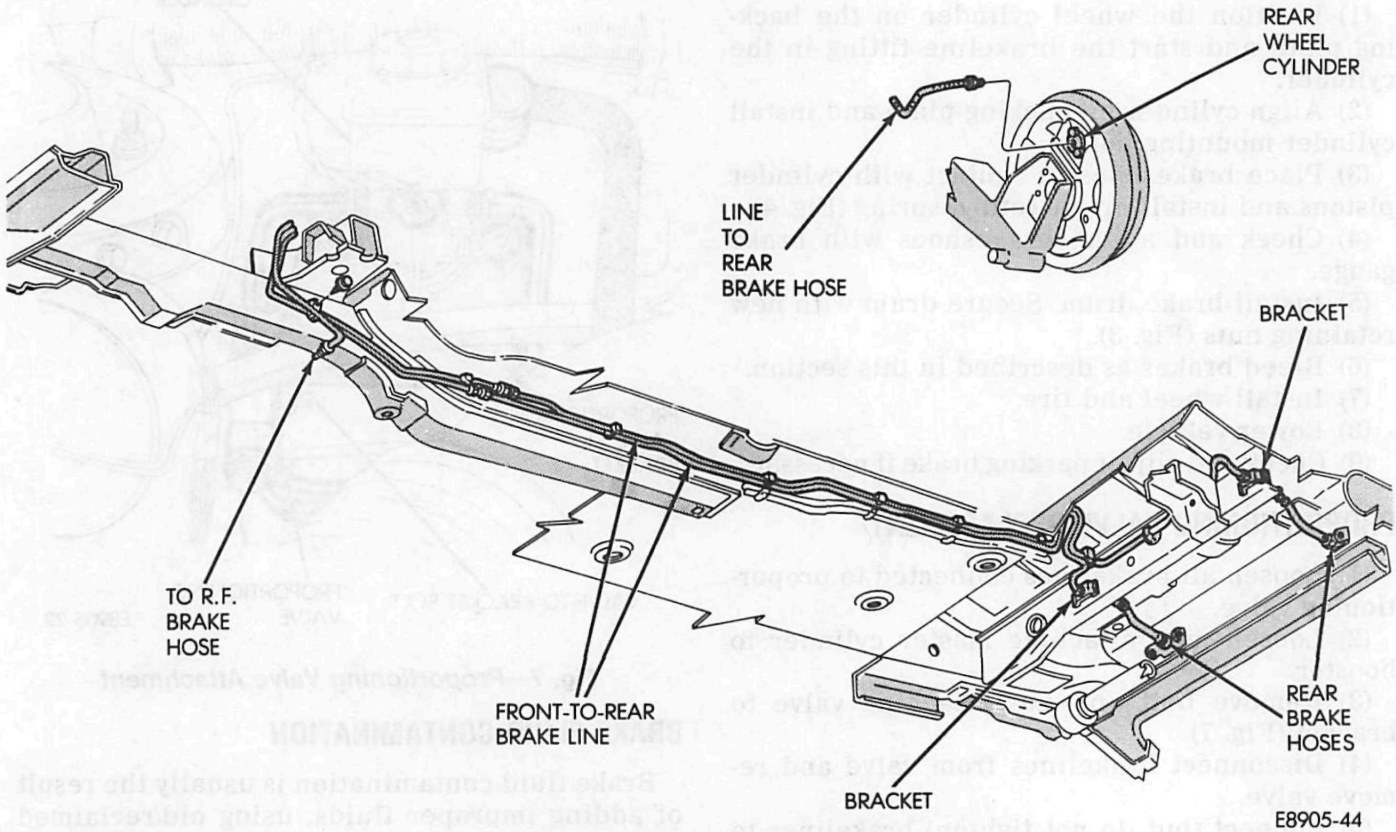


Fig. 9—Rear Brakeline Routing

become porous and deteriorate.

If fluid contamination is suspected, drain off a sample from the master cylinder. A suction gun or similar device can be used for this purpose.

Empty the drained fluid into a glass container. Contaminants in the fluid will cause the fluid to separate into distinct layers. If contamination has occurred, the system rubber seals, hoses and cups should be replaced and the system thoroughly flushed with clean brake fluid.

BRAKE BLEEDING

Bleed the hydraulic system whenever diagnosis indicates air has entered the system. If the fluid is also contaminated, flush the system completely with fresh brake fluid.

Use Mopar brake fluid or equivalent meeting DOT and SAE standards J1703F and DOT 3 to fill the bleeding apparatue and system.

The brake hydraulic system can be bled manually or with pressure equipment. When using pressure equipment, follow the manufacturers instructions explicitly.

CAUTION: The rear wheels on Premier models must be at normal ride height for satisfactory wheel cylinder bleeding. Air can be trapped in the wheel cylinders if the rear wheels are at full jounce position. Position the vehicle on a drive-on hoist or raise the rear wheels to normal ride height before bleeding.

Manual Bleeding

(1) Fill master cylinder with new brake fluid.
(2) Bleed wheels in following sequence:
  (a) right rear
  (b) left rear
  (c) right front
  (d) left front
(3) Bleed only one wheel brake unit at a time.
(4) Install bleed hose on caliper or cylinder bleed fitting. Submerge free end of hose in container partially filled with brake fluid.

CAUTION: Do not allow the master cylinder to run out of fluid while bleeding the brakes. An empty cylinder will allow air to be drawn into the system. Check the cylinder fluid level frequently and add fluid as needed.

(5) Open caliper or cylinder bleed fitting 3/4 turn.
(6) Have helper press and hold brake pedal. Tighten bleed fitting and have helper release brake pedal. Continue this operation until fluid is clear and free of bubbles.
(7) Repeat bleeding operation at remaining wheel brake units.
(8) Discard all fluid removed during the bleeding operation.
(9) Fill master cylinder reservoir.
(10) Verify proper brake operation.

Pressure Bleeding

(1) Release air from bleeder pressure tank.
(2) Fill bleeder supply tank with brake fluid.
(3) Close bleeder tank-to-master cylinder fluid supply valve.
(4) Charge bleeder pressure tank to 15-20 psi (103 to 138 kPa) air pressure.
(5) Remove filler cap from reservoir cover and install bleeder adapter in place of cap.
(6) Connect adapter fluid supply hose to supply valve in tank.
(7) Connect air supply hose to adapter.
(8) Place end of fluid supply hose in clean container. Then slowly open tank fluid supply valve to purge air from tank and hose.
(9) Close valve when fluid flows clear and free of air bubbles.
(10) Recharge tank if pressure falls below 15-20 psi.
(11) Remove adapter fitting from hose and install it in master cylinder adapter.
(12) Connect fluid supply hose to adapter fitting and open tank fluid supply valve.
(13) Use following bleed sequence:
  (a) right rear
  (b) left rear
  (c) right front
  (d) left front
(14) Bleed only one wheel brake unit at a time.
(15) Install rubber hose on caliper or cylinder bleed fitting. Submerge end of hose in container partially filled with brake fluid.
(16) Open caliper or cylinder bleed fitting 3/4 turn. Close fitting when fluid flows clear and free of air bubbles.
(17) After bleeding all wheels, disconnect fluid supply hose and remove adapter from reservoir.
(18) Discard fluid removed during bleeding.
(19) Fill master cylinder reservoir and install filler cap.
(20) Release bleeder tank air pressure and close fluid supply valve.
(21) Verify proper brake operation.

FRONT DISC BRAKE SERVICE

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BRAKESHOE REPLACEMENT

Brakeshoe Removal

(1) Drain 1/3 of fluid from master cylinder reservoir.

(2) Raise and support front of vehicle.

(3) Remove front wheels

(4) Press caliper piston back into bore with pry tool or C-clamp (Fig. 1).

(5) Remove caliper slide pins (Fig. 2).

(6) Lift and remove caliper from mounting bracket (Fig. 3). **Secure caliper to suspension component with wire. Do not allow brake hose to support caliper weight.**

(7) Remove outboard brakeshoe from caliper bracket (Fig. 4).

(8) Remove inboard brakeshoe from caliper bracket (Fig. 5).

(9) Remove anti-rattle springs from shoes.

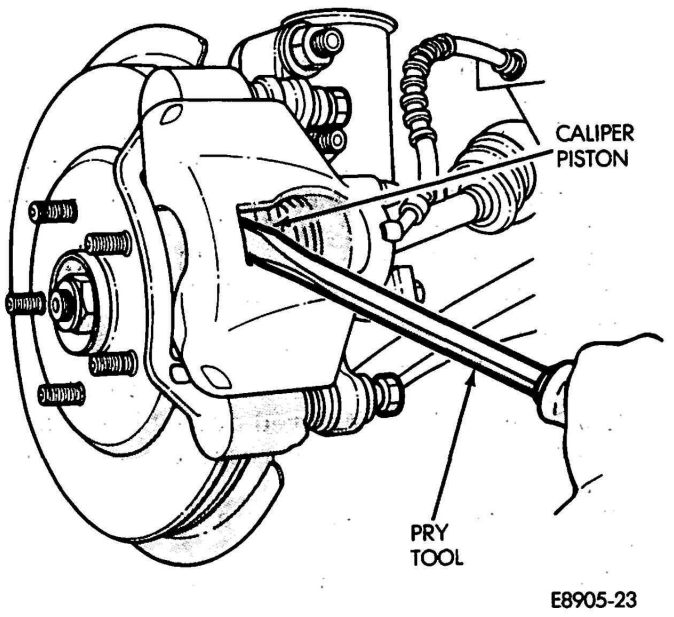


Fig. 1—Pressing Caliper Piston Into Bore

Brakeshoe Installation

(1) Clean brakeshoe contact points on caliper bracket with wire brush. Then lubricate contact points with chassis grease.

(2) Check slide pins, bushings, sleeves and retainers (Fig. 6). Replace these components if corroded, worn, or damaged. Do not attempt to repair them.

(3) Install anti-rattle springs on brakeshoes (Fig. 7).

(4) Install brakeshoes in caliper bracket (Figs. 4 and 5).

(5) Install sleeves and bushings in caliper if not previously installed (Fig. 8).

(6) Install bushing retainers.

(7) Remove wire securing caliper to suspension component.

(8) Install caliper over shoes and in bracket.

(9) Install and tighten caliper slide pins to 20-30 N·m (15-22 ft-lbs) torque.

(10) Install wheel and lower vehicle.

(11) Pump brake pedal to seat caliper pistons and brakeshoes.

(12) Top off fluid level in master cylinder reservoir.

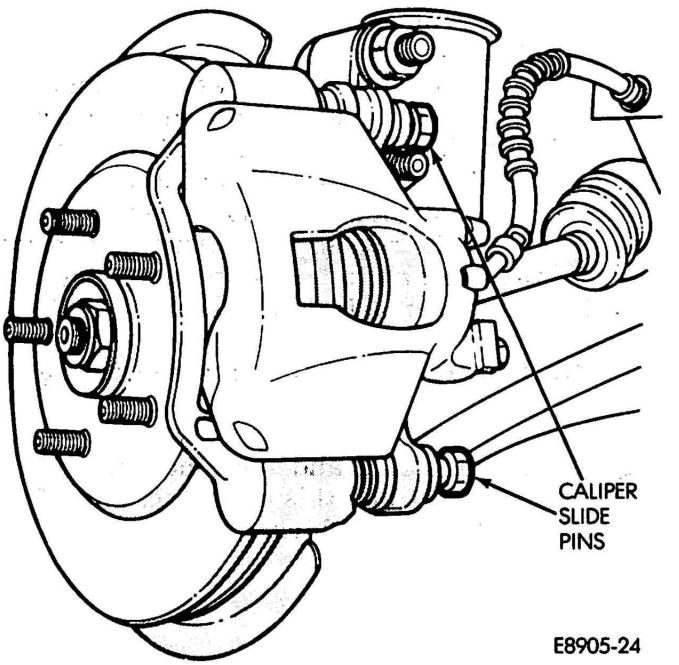


Fig. 2—Removing/Installing Caliper Slide Pins

CALIPER REMOVAL

(1) Raise and support vehicle.
(2) Remove wheels.
(3) Remove fitting bolt and disconnect brake hose from caliper (Fig. 9).
(4) Remove caliper slide pins (Fig. 2).
(5) Lift caliper up and out of bracket.

CALIPER INSTALLATION

(1) Install brakeshoes if removed.
(2) Install caliper over brakeshoes and in bracket.
(3) Connect brake hose to caliper. Position brake hose as shown in Figure 9.
(4) Install and tighten the caliper slide pins to 20-30 N·m (15-22 ft-lbs) torque.
(5) Fill the master cylinder and bleed the brakes.
(6) Install the wheels.
(7) Remove supports and lower vehicle.

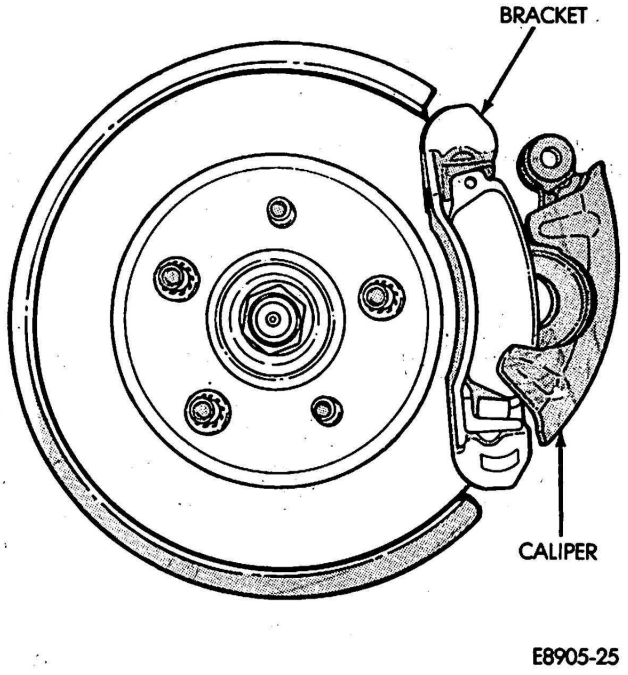


Fig. 3—Removing/Installing Caliper

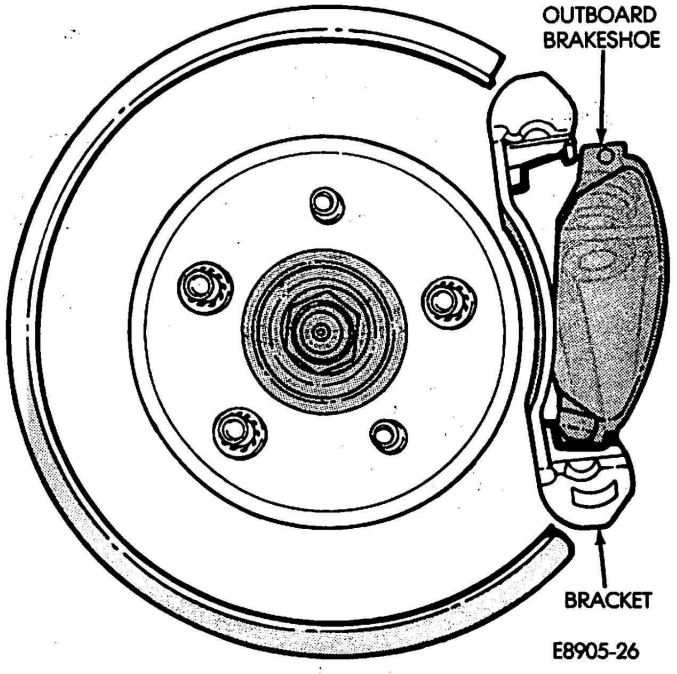


Fig. 4—Removing/Installing Inboard Brakeshoe

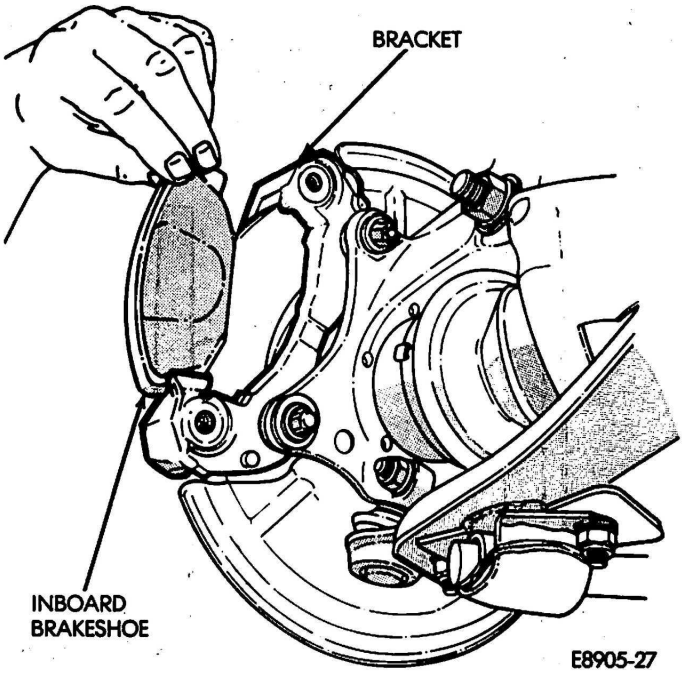


Fig. 5—Removing/Installing Outboard Brakeshoe

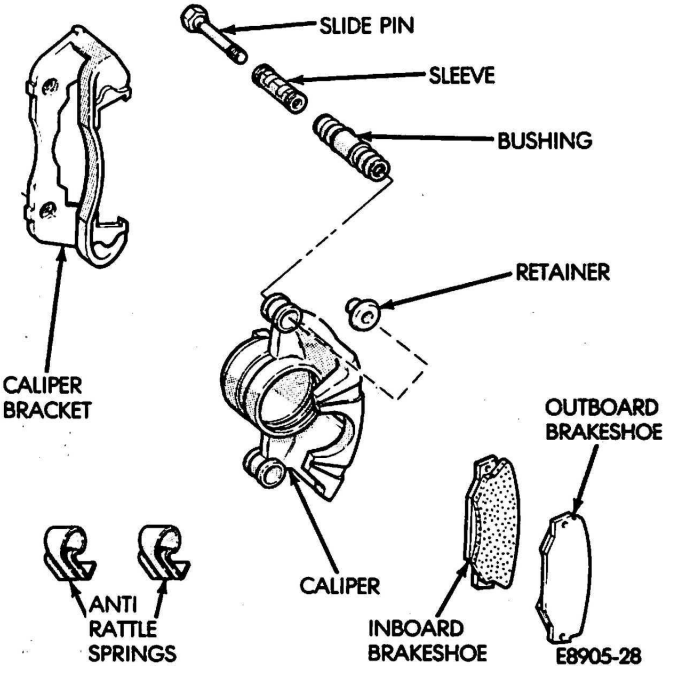


Fig. 6—Caliper and Brakeshoe Components

CALIPER OVERHAUL

Caliper Disassembly

(1) Remove caliper as described in this section.
(2) Pry dust seal out of caliper (Fig. 10).
(3) Place wood block between caliper piston and caliper body (Fig. 11).
(4) Remove caliper piston with compressed air (Fig. 11). Apply air through caliper fluid inlet port. Use only enough air to ease the piston out of the bore.
(5) Remove caliper piston seal (Fig. 12). Use brass feeler gauge or wood pencil to remove seal.
(6) Remove bleed screw and cap (Fig. 13).
(7) Remove the sleeves, bushings and retainers from the caliper.

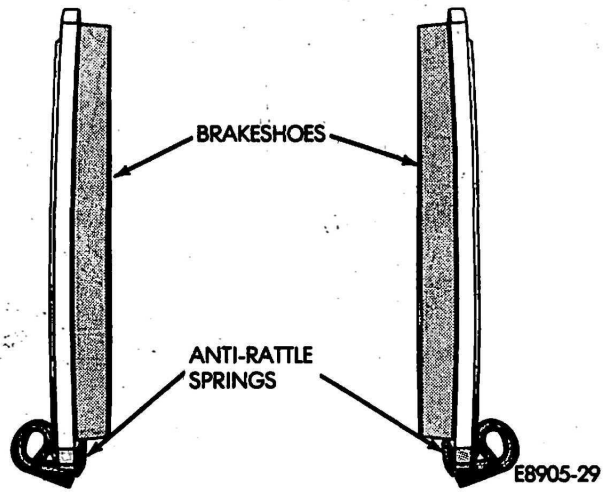


Fig. 7—Anti-Rattle Spring Position

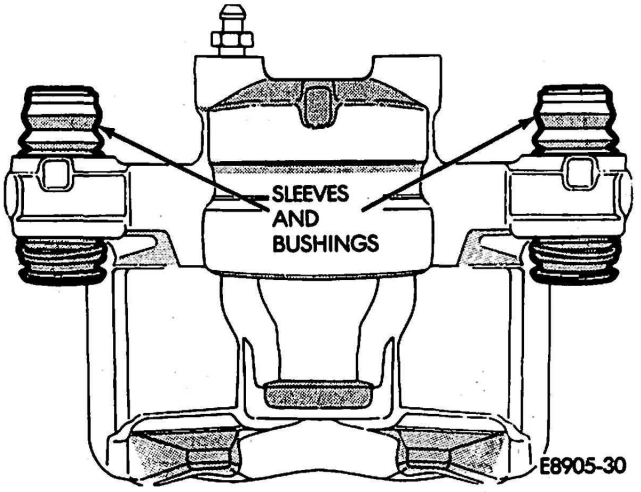


Fig. 8—Sleeve and Bushing Position

Cleaning and Inspection

Clean the caliper and piston with Mopar brake cleaner or clean brake fluid only. Do not use any other type of cleaning agents.

Inspect the piston bore and caliper piston surface. Replace the caliper and piston if scored, corroded, or pitted. **Do not attempt to repair the piston or bore by honing, polishing or sanding. Honing will make the bore tapered or oversize. Sanding or polishing the piston will ruin the surface finish causing the piston to corrode and bind.**

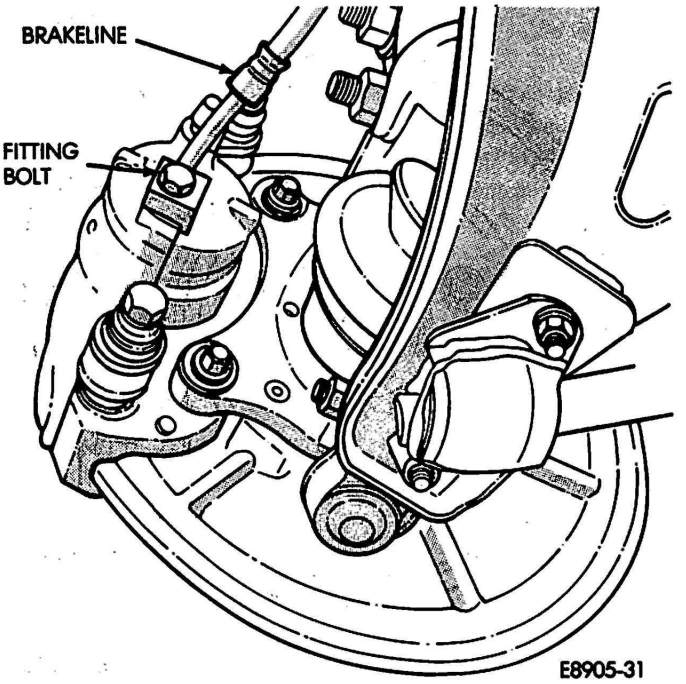


Fig. 9—Disconnecting/Connecting Caliper Brakeline

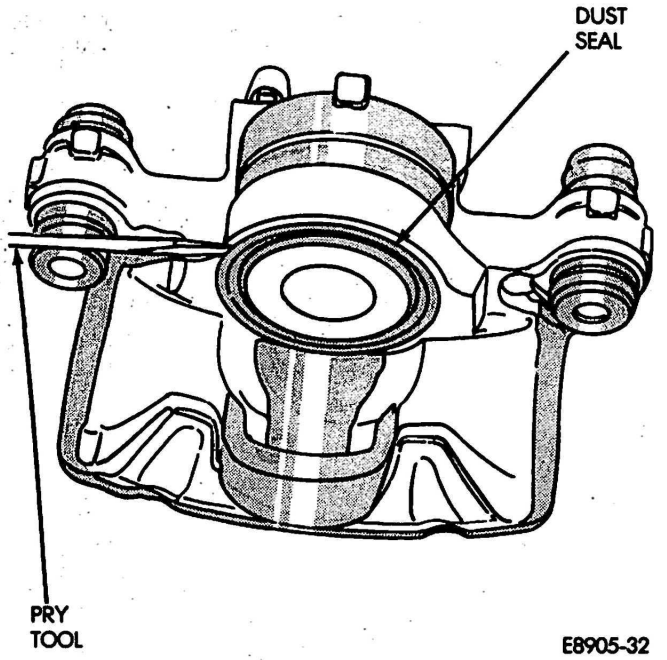


Fig. 10—Removing Caliper Piston Dust Boot

Replace the caliper slide pins, sleeves, bushings and retainers if worn or corroded. Do not sand or polish the slide pins. Replace the pins if worn or damaged.

Caliper Assembly

(1) Lubricate caliper bore, piston and new piston seal with clean brake fluid.

(2) Install piston seal in caliper bore. Be sure seal is seated in groove.

(3) Install new dust seal on caliper piston as follows:

(a) Slide metal portion of seal upward over piston (Fig. 14).

(b) Pull metal part of seal up until lip of seal boot seats in piston groove (Fig. 14).

(c) Fold seal boot down until flush with end of piston (Fig. 15).

(4) Install caliper piston in bore. Press piston to bottom of bore with a push and turn motion. Also rock the piston slightly to ease installation.

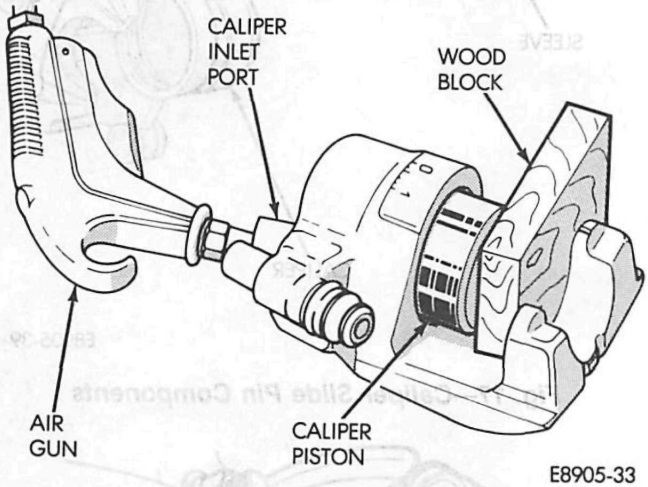


Fig. 11—Removing Caliper Piston

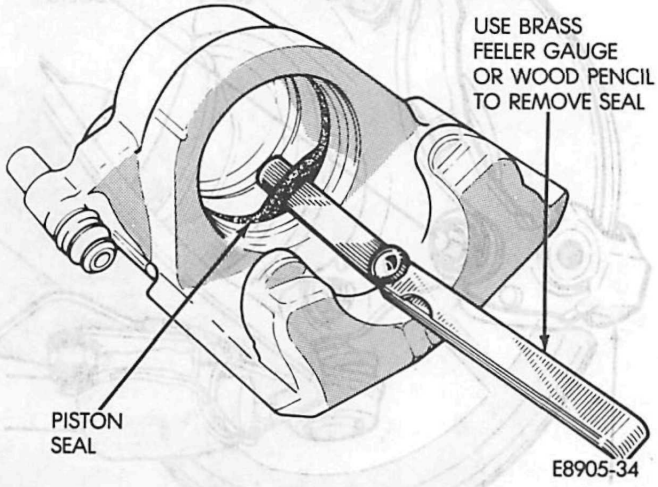


Fig. 12—Removing Caliper Piston Seal

(5) Seat metal part of dust seal in caliper with installer tool 7021 and adaptor 6178 (Fig. 16).

(6) Install sleeves, bushings and retainers in caliper (Fig. 17).

(7) Install bleed screw and install cap on bleed screw (Fig. 13).

ROTOR REMOVAL

(1) Raise and support vehicle.

(2) Remove wheel.

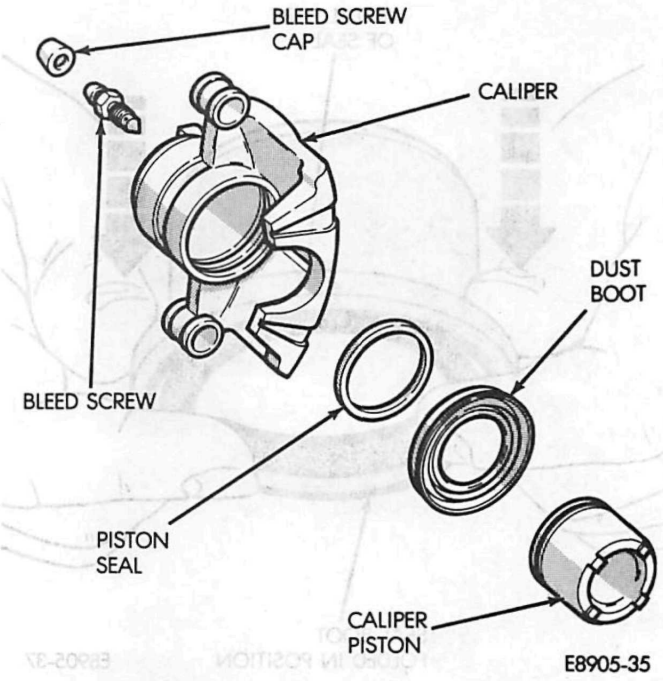


Fig. 13—Caliper Components

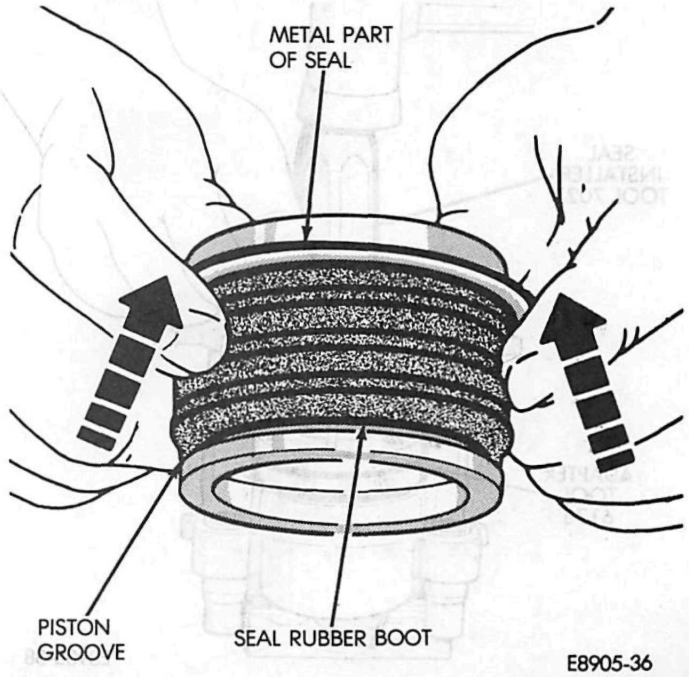


Fig. 14—Installing Dust Seal On Piston

(3) Remove caliper and brakeshoes. Secure caliper to suspension component. Do not allow brake hose to support caliper weight.
(4) Remove bolts attaching caliper bracket to steering knuckle (Fig. 18).
(5) Remove rotor retainer nuts (Fig. 19).
(6) Remove rotor from hub (Fig. 20).

ROTOR INSTALLATION

(1) Install rotor on hub and studs (Fig. 20).
(2) Install rotor retainer nuts (Fig. 19).
(3) Install caliper bracket on steering knuckle (Fig. 18).
(4) Install and tighten caliper bracket bolts to 95 N·m (70 ft-lbs) torque.
(5) Remove wire temporarily securing caliper to suspension component.
(6) Install caliper on bracket.
(7) Install wheel and lower vehicle.
(8) Top off master cylinder fluid level if necessary.

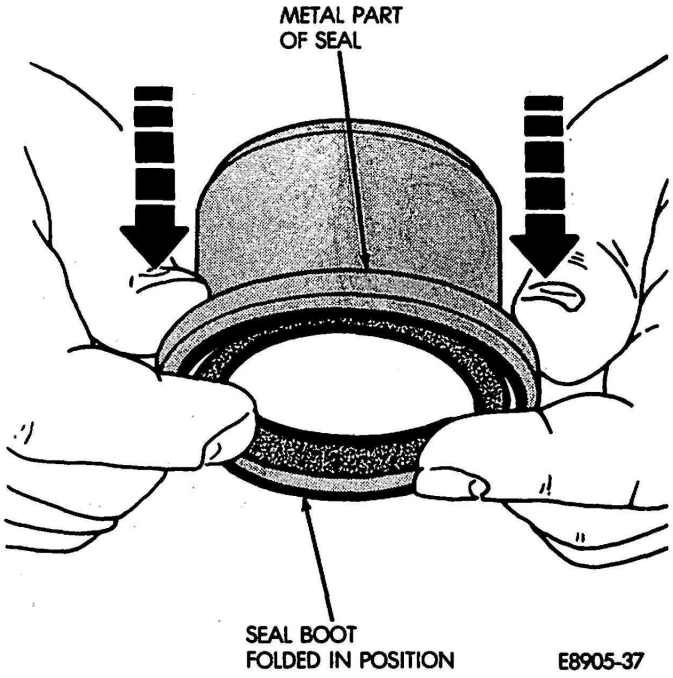


Fig. 15—Folding Seal Boot Into Position

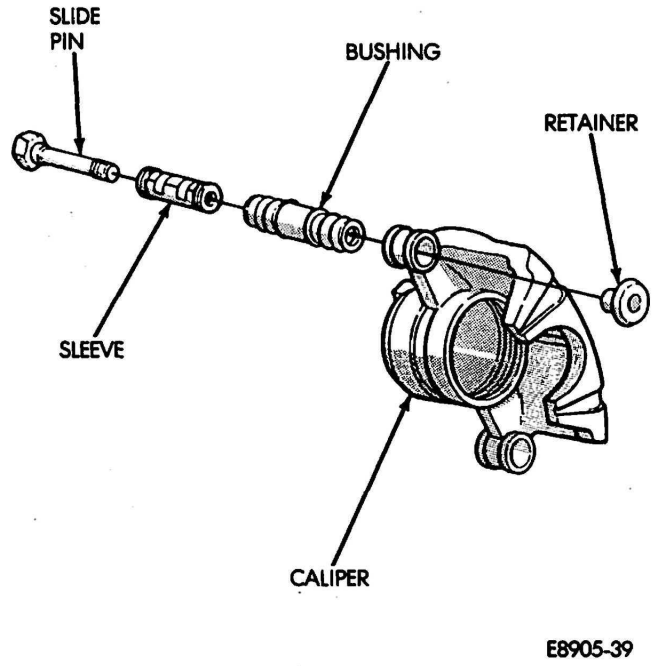


Fig. 17—Caliper Slide Pin Components

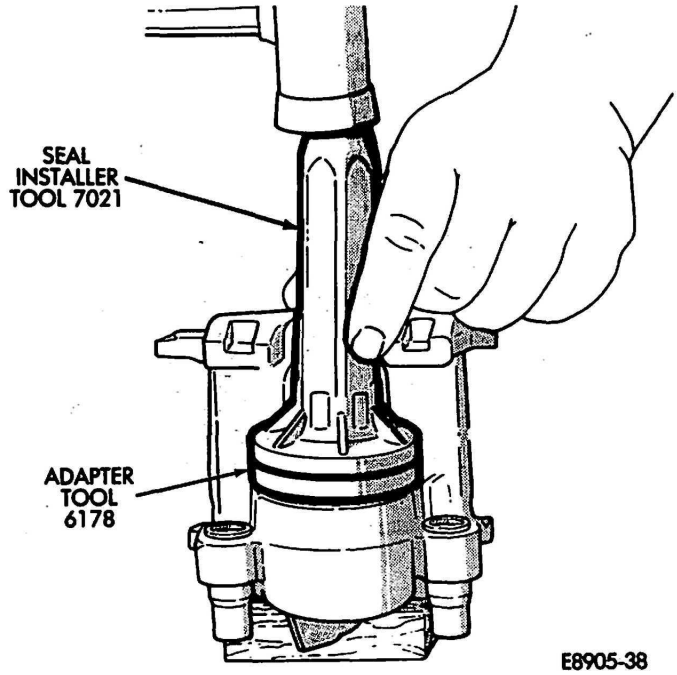


Fig. 16—Seating Dust Seal in Caliper

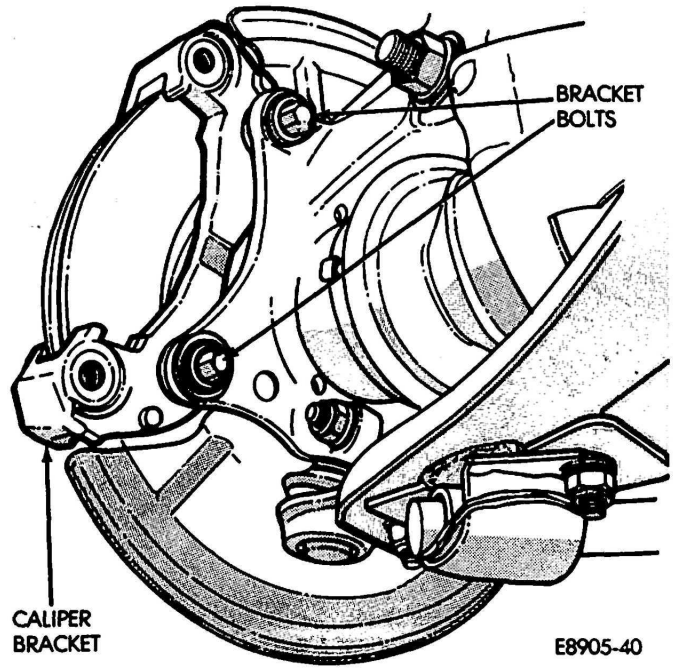


Fig. 18—Removing/Installing Caliper Bracket

ROTOR SERVICE

The disc brake rotors on Premier models can be sanded and/or machined to restore surface finish and concentricity. However, the rotors should be replaced if the braking surfaces are severely worn, scored, tapered, or out of tolerance.

The minimum allowable thickness for Premier front disc brake rotors is 20.5 mm (.807 inch). Replace the rotor if worn below this limit or if machining would take the rotor below the stated limit.

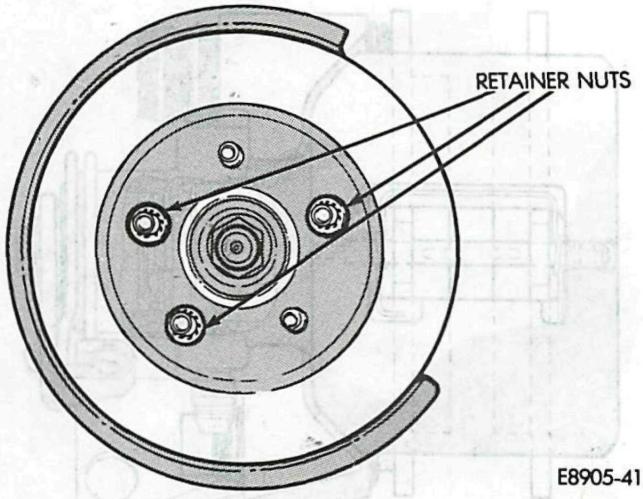


Fig. 19—Removing/Installing Rotor Retainer Nuts

The maximum allowable lateral runout for rotors is .08 mm (.003 inch). Replace the rotors if runout exceeds this limit.

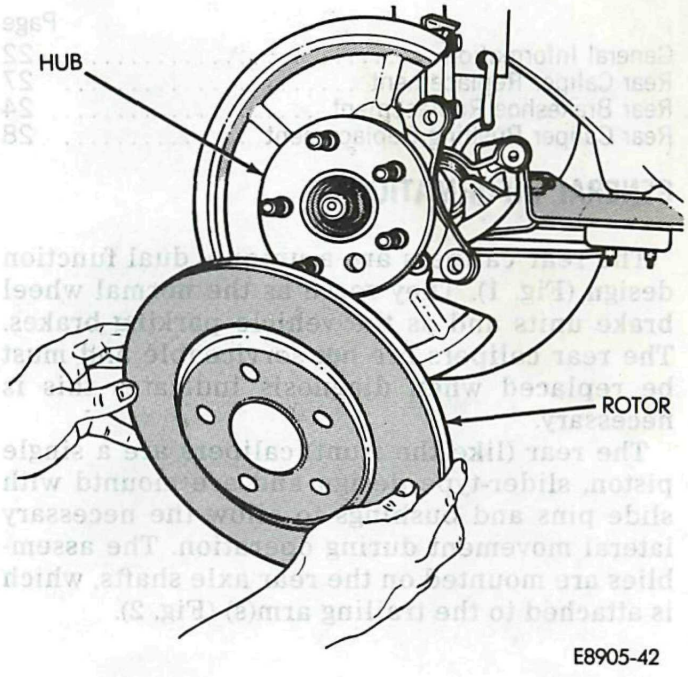


Fig. 20—Removing/Installing Disc Brake Rotor

REAR DISC BRAKE SERVICE

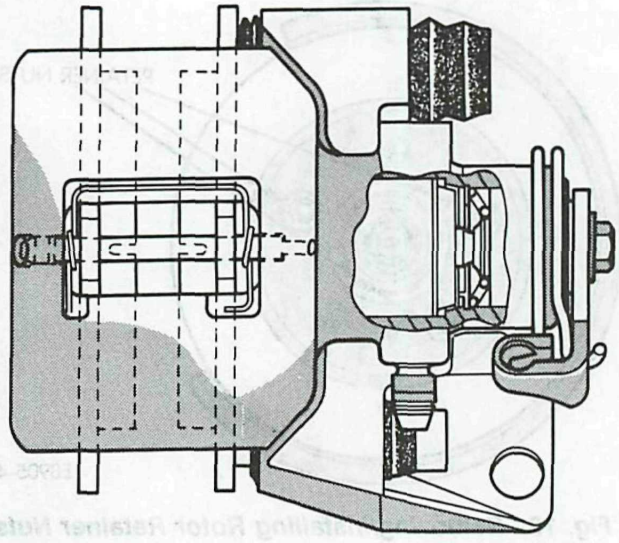
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GENERAL INFORMATION

The rear calipers are a unique, dual function design (Fig. 1). They serve as the normal wheel brake units and as the vehicle parking brakes. The rear calipers are **not** serviceable and must be replaced when diagnosis indicates this is necessary.

The rear (like the front) calipers are a single piston, slider-type design and are mountd with slide pins and bushings to allow the necessary lateral movement during operation. The assemblies are mounted on the rear axle shafts, which is attached to the trailing arm(s) (Fig. 2).



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Fig. 1—Rear Disc Brake Caliper

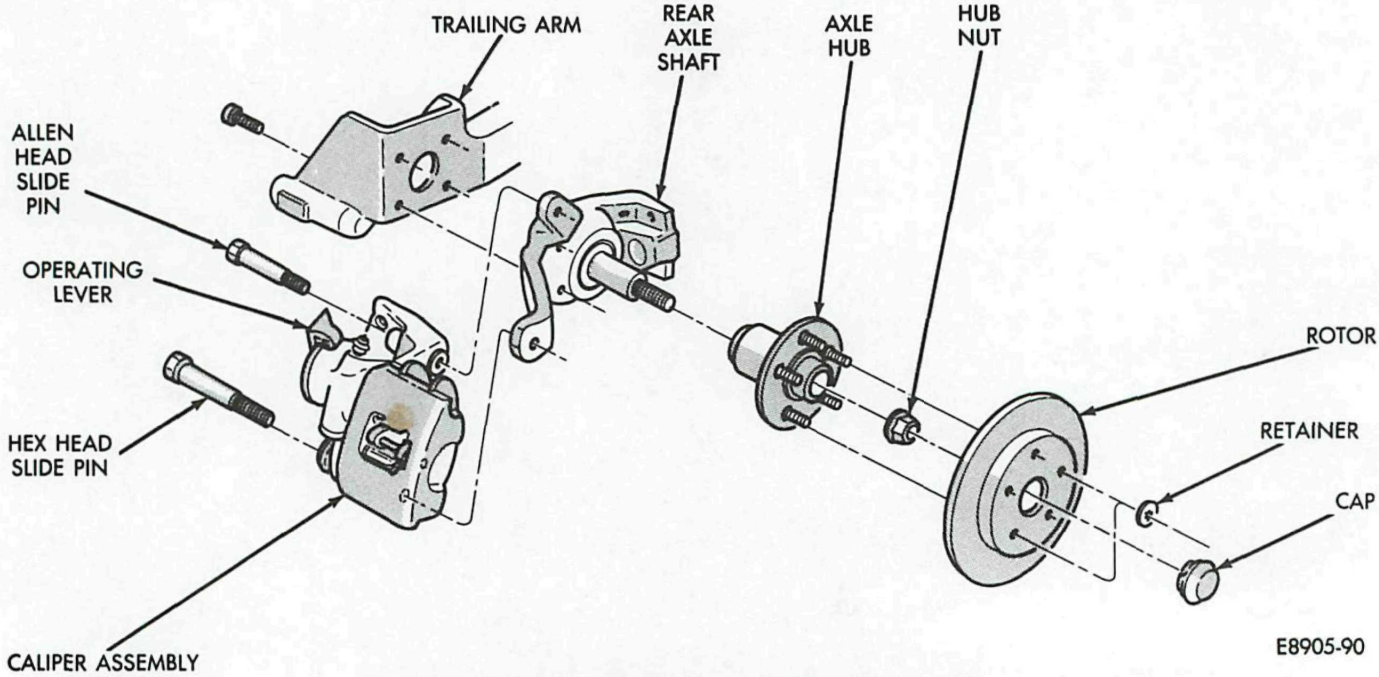


Fig. 2—Caliper Mounting (Right Rear Caliper)

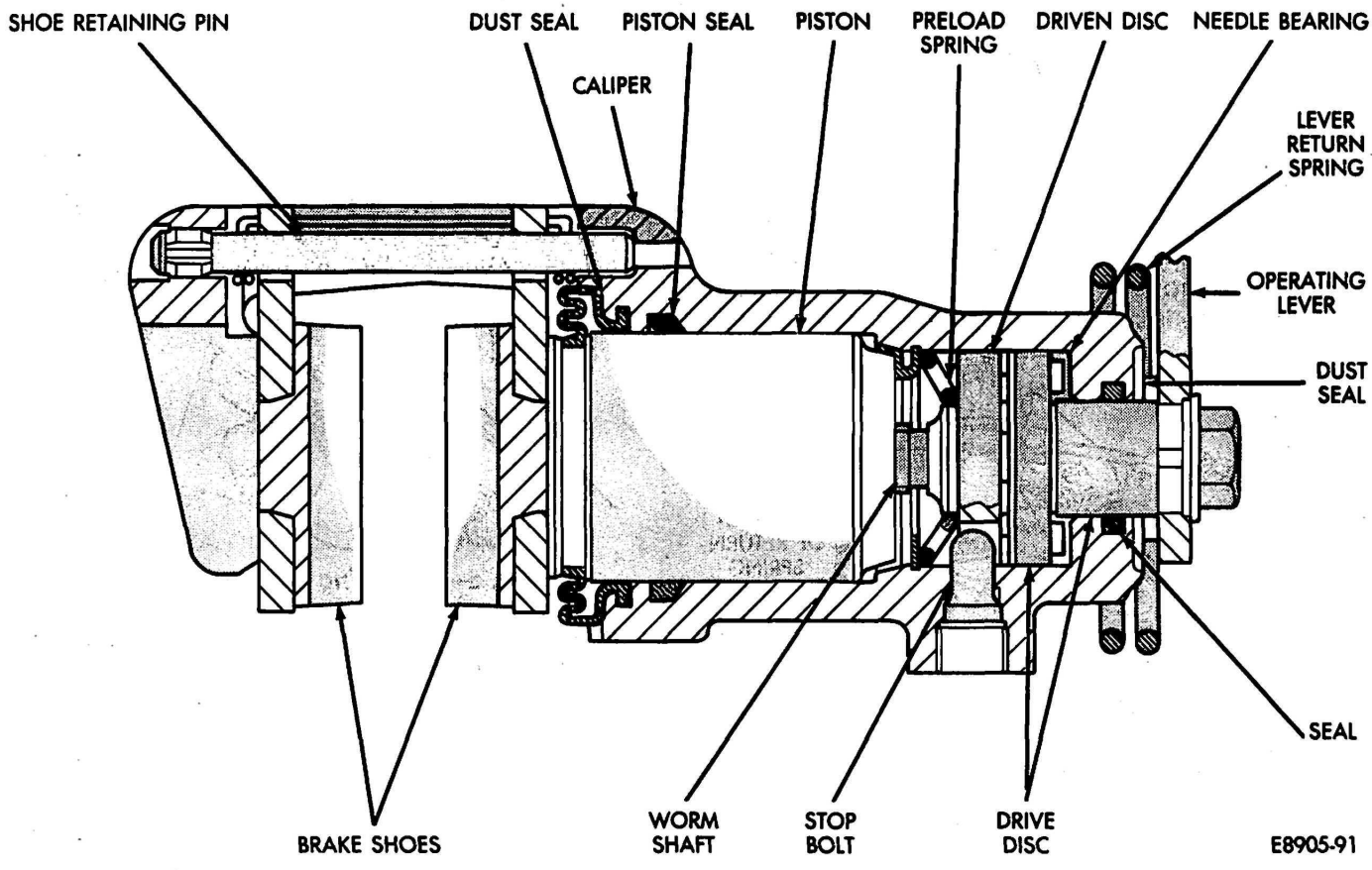


Fig. 3—Rear Caliper Internal Components

REAR CALIPER AND PARKING BRAKE OPERATION

The rear calipers have a two-stage (stepped) cylinder bore. The piston is located in the large diameter part of the bore. The parking brake adjuster mechanism is located in the smaller diameter part of the bore (Fig. 3).

The complete parking brake mechanism consists of: the caliper piston; a worm shaft; two discs (drive and driven); a disc preload spring; and an operating lever and return spring (Fig. 3). The parking brake cables are attached to the operating levers.

The worm shaft is attached to the piston with a spring washer and lock ring. The driven disc is threaded to the worm shaft and the drive disc is seated in the caliper. The operating lever is bolted to the drive disc. The lever is connected to and operated by the parking brake rear cable. The lever return spring is attached to the lever and to a lug on the caliper body.

The drive disc rotates the spring loaded driven disc by means of ball bearings. The bearings are secured to the drive disc and seat in cam ramps machined in the driven disc.

In normal braking mode, the rear calipers operate the same as the front calipers. The brakeshoes are applied by fluid pressure acting against the caliper piston and bore surfaces.

When the parking brakes are applied, the rear cables pull the caliper operating levers forward. This rotates the discs and worm shaft causing the piston to extend and apply the brakes. Since normal brakeshoe operating clearance is quite small, only a modest amount of piston movement is needed for brake application. A stop bolt is used to limit the total amount of piston extension.

The parking brake mechanism is self adjusting to compensate for lining wear. As wear occurs, drive-to-driven disc clearance increases. This causes the drive disc ball bearings to move farther up the cam ramps in the driven disc increasing the amount of rotation. The extra rotation produced is enough to extend the piston for adjustment.

The only serviceable components on the rear disc brake assembly are the brakeshoes, operating lever, lever return spring and the slider pins, bushings and boots. The rear calipers are not serviceable and must be replaced if diagnosis reveals a problem.

SERVICE PROCEDURES

REAR BRAKESHOE REPLACEMENT

Brakeshoe Removal

(1) Raise the vehicle.

(2) Remove the wheel.

CAUTION: Do not attempt to press the caliper piston back into the bore at this time. A special procedure and service tool are required for this task. Refer to the Brakeshoe Installation procedure for details.

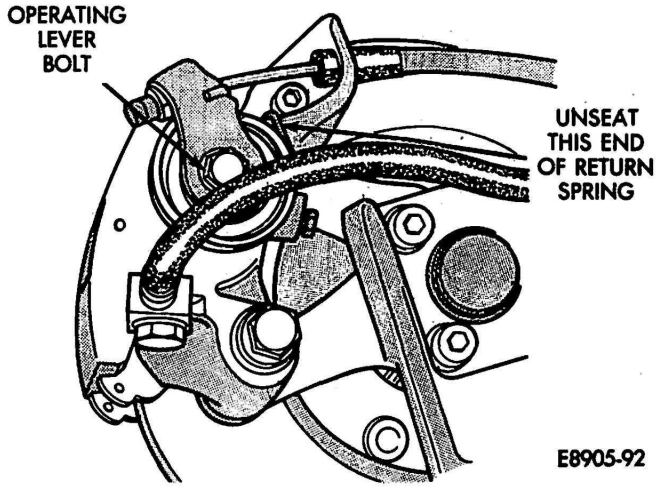


Fig. 4—Operating Lever and Return Spring Attachment

(3) Unseat the operating lever return spring at the caliper (Fig. 4).

(4) Remove the bolt attaching the operating lever to the drive disc (Fig. 4).

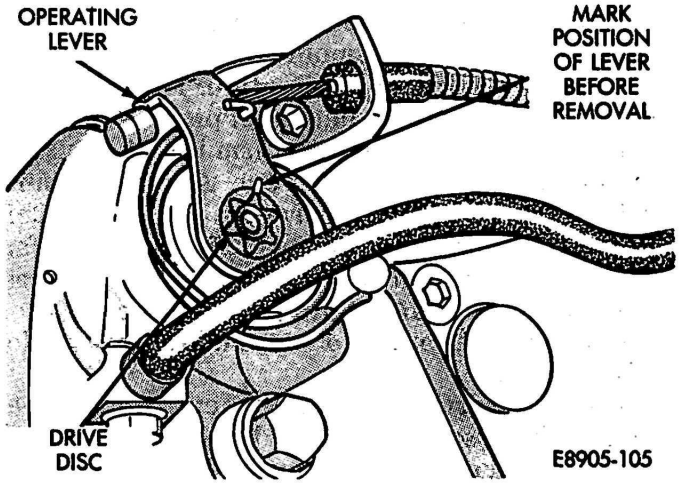


Fig. 5—Mark Operating Lever Position

(5) Mark position of the operating lever before removal (Fig. 5). Use paint or scriber to mark the caliper drive disc and operating lever.

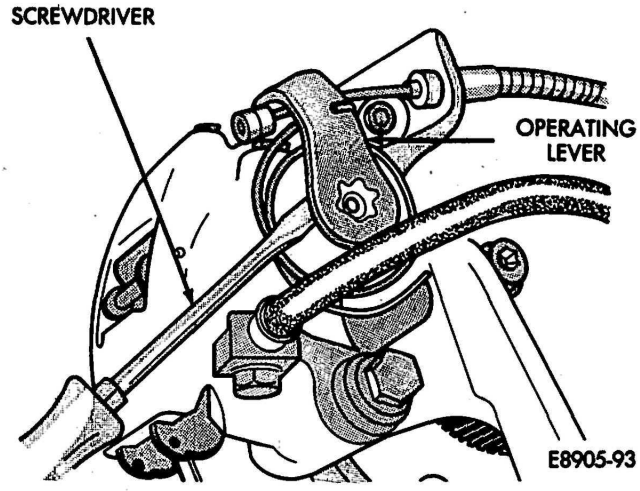


Fig. 6—Removing Operating Lever

(6) Remove the operating lever with a flat blade screwdriver (Fig. 6).

(7) Remove the operating lever and return spring from the parking brake cable. Replace the return spring if it is warped, bent or distorted.

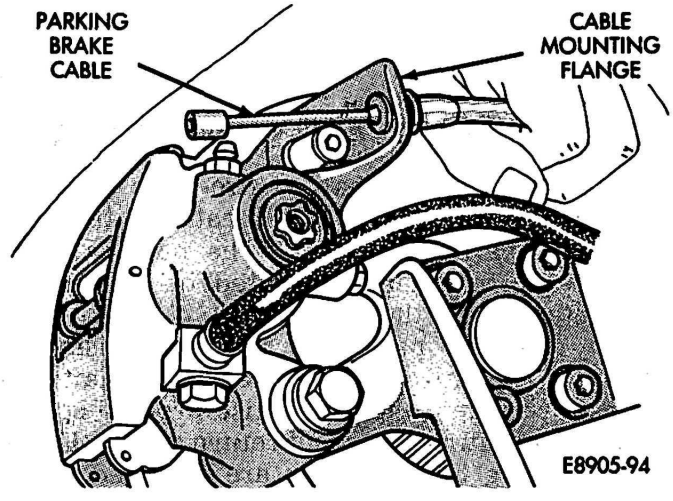


Fig. 7—Removing Parking Brake Cable From Flange

(8) Pull the parking brake cable out of the mounting flange (Fig. 7).

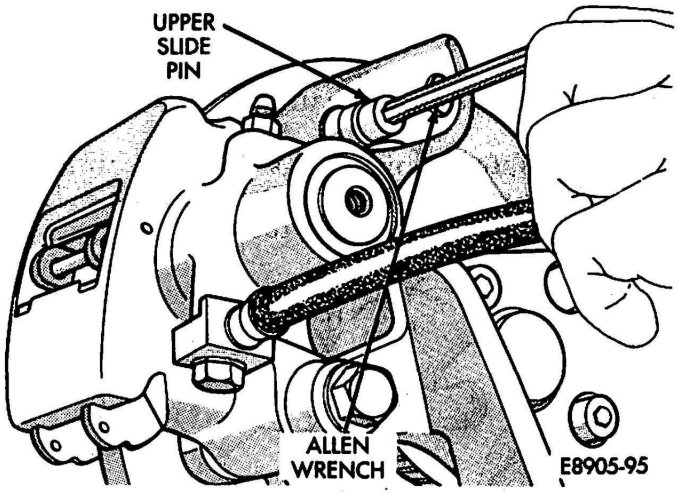


Fig. 8—Removing Upper Slide Pin

(9) Remove the upper slide pin with an Allen wrench (Fig. 8).

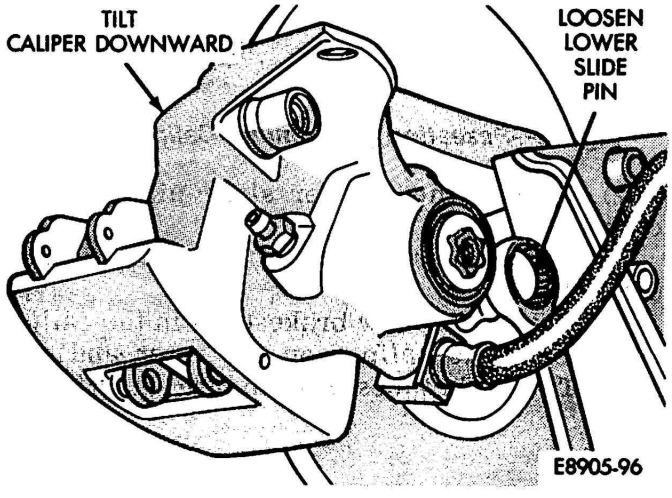


Fig. 9—Tilting Caliper Rearward

(10) Loosen the lower slide pin and tilt the caliper rearward (Fig. 9). Do not remove the slide pin completely at this time.

(11) Remove the brakeshoe retaining pin with a pin punch (Fig. 10). Check condition of the sleeves on the pin. Replace the pin if corroded, or the sleeves are worn or damaged.

(12) Remove the lower slide pin completely and lift the caliper off the rotor.

(13) Remove the anti-rattle spring and the brakeshoes (Fig. 11).

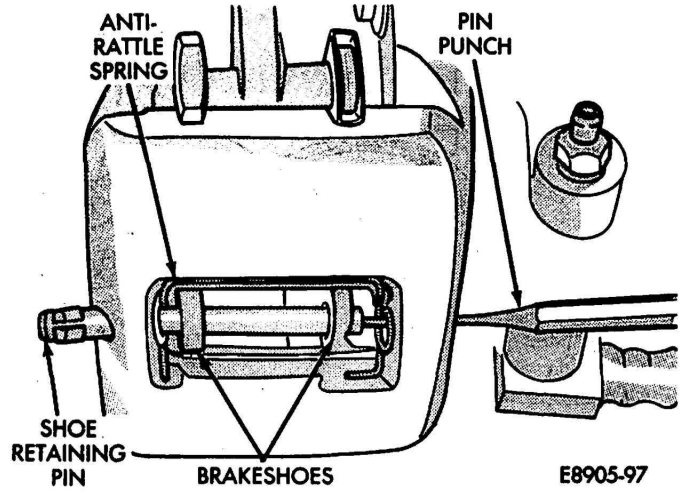


Fig. 10—Removing Brakeshoe Retaining Pin

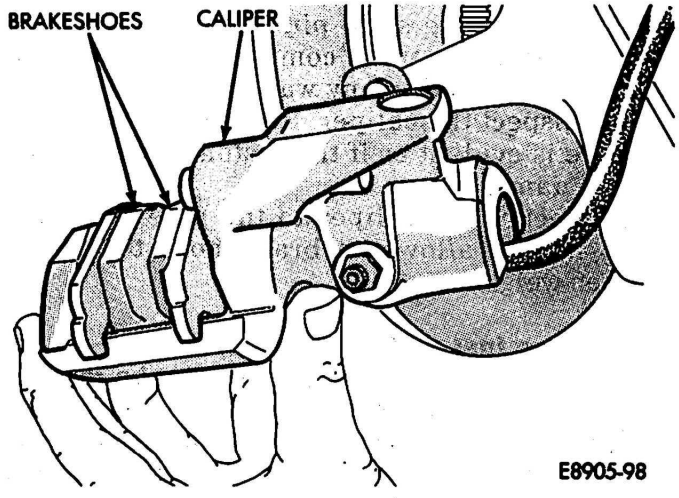


Fig. 11—Brakeshoe Removal

(14) Remove the rotor retaining nuts and remove the rotor (Fig. 12).

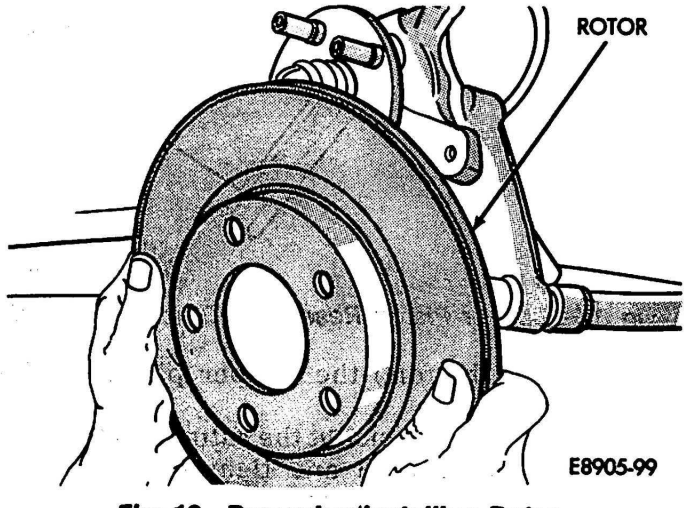


Fig. 12—Removing/Installing Rotor

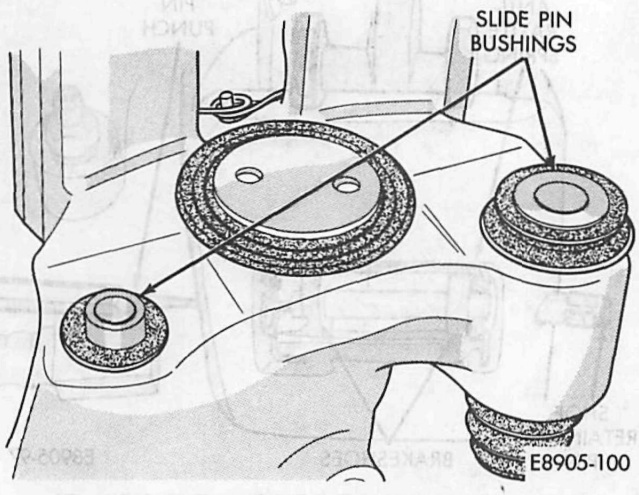


Fig. 13—Inspect Slide Pin Bushings

(15) Inspect the slide pin bushings and boots (Fig. 13). Replace these components if corroded, worn, or damaged in any way.

(16) Inspect the caliper. Replace the caliper if leakage is evident or if the piston or piston dust boot is damaged.

(17) Secure the caliper to the axle shaft with wire. Do not allow the brake hose to support caliper weight.

Brakeshoe Installation

CAUTION: The rear caliper piston must be reseated (bottomed) to compensate for new brakelining. However, because the parking brake self adjuster mechanism is attached to the piston, a different seating method is required. The only acceptable method, is by rotating the piston back into the bore with spanner tool 6366 (Fig. 14) as described below. Any other seating method will damage the self-adjuster mechanism.

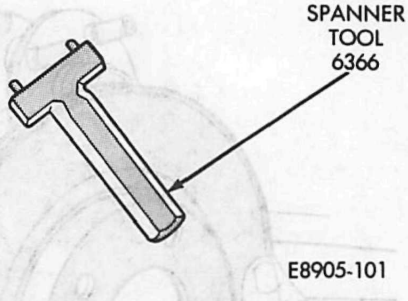


Fig. 14—Caliper Piston Reseating (Bottoming) Tool

(1) Reseat (bottom) the caliper piston in the bore as follows:

(a) Temporarily mount the caliper on the axle shaft (Fig. 15). Install and tighten the caliper slide pins just enough to hold the caliper in place.

(b) Assemble a 3/8 drive extension, ratchet handle and 7/16 deep-well socket (Fig. 15).

(c) Insert spanner tool 6366 into the deep well socket (Fig. 15).

(d) Insert the spanner tool lugs into the matching holes in the caliper piston face (Fig. 15).

(e) Rotate the piston in a **clockwise** direction until fully seated (bottomed) in the bore. Then remove the piston rotating tools.

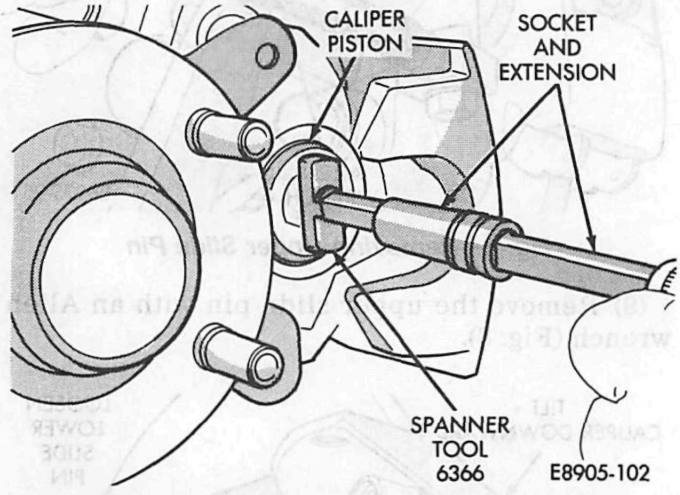


Fig. 15—Reseating (Bottoming) Caliper Piston

(2) Remove the caliper slide pins and the caliper.

(3) Install the rotor and rotor retaining nuts (Fig. 12).

(4) Position the new brakeshoes in the caliper and install the caliper on the rotor and axle shaft. The brakeshoes (Fig. 16) are interchangeable.

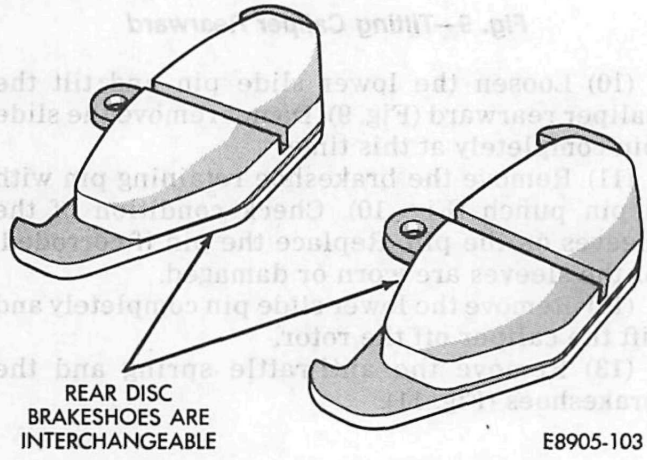


Fig. 16—Rear Disc Brakeshoes

(5) Install the caliper slide pins. Tighten the small diameter pin to 28 N·m (21 ft-lbs) torque and the larger diameter pin to 48 N·m (36 ft-lbs) torque.

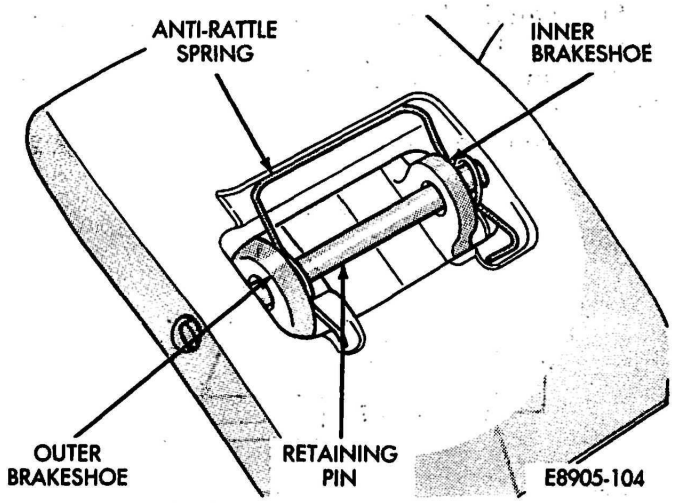


Fig. 17—Brakeshoe, Anti-Rattle Spring And Retaining Pin Position

(6) Install the anti-rattle spring (Fig. 17). Be sure the spring is positioned so the brakeshoe retaining pin will go through the brakeshoes and the loops at each end of the anti-rattle spring.

(7) Install the brakeshoe retaining pin. Be sure the pin goes through both brakeshoes and the loops of the anti-rattle spring as shown (Fig. 17).

(8) Insert the parking brake cable in the caliper flange (Fig. 7).

(9) Position return spring on the caliper.

(10) Install the operating lever on the parking brake cable.

(11) Pull the parking brake cable rearward and install the operating lever on the caliper drive disc.

(12) Before installing the return spring, note the return spring ends (Fig. 18). The rounded end goes on the operating lever. The square end goes on the caliper.

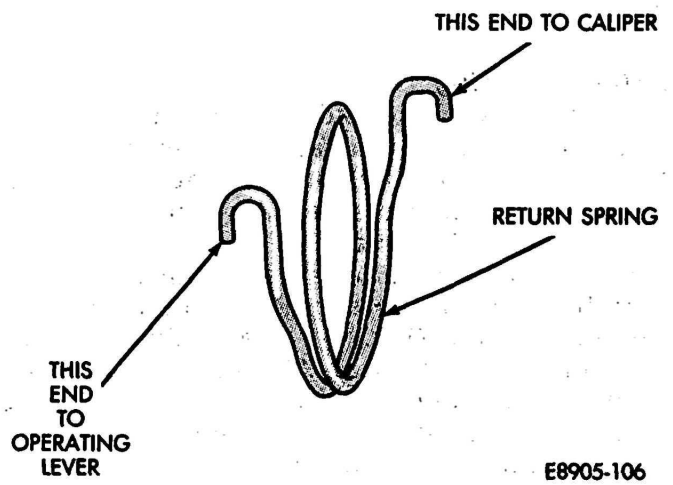


Fig. 18—Return Spring Identification

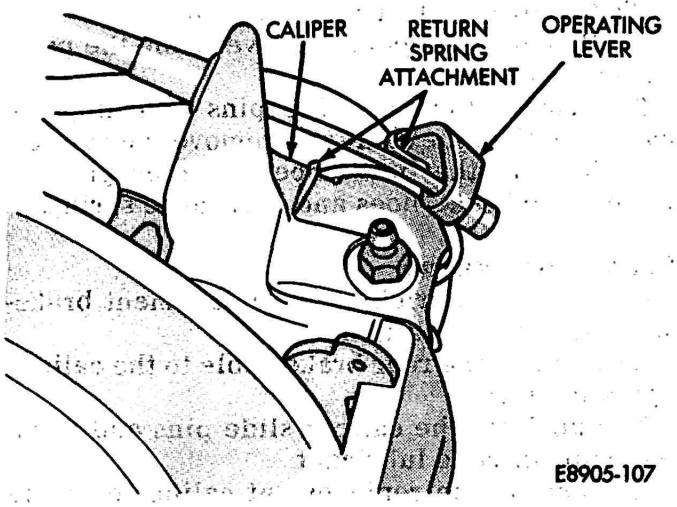


Fig. 19—Return Spring Installation

(13) Connect the return spring (Fig. 19). Connect the spring to the operating lever first. Then hook the spring onto the caliper with a long screwdriver.

(14) Install the wheel and tire.

(15) Lower the vehicle.

(16) Apply the brakes several times to seat the brakeshoes and equalize parking brake adjustment.

REAR CALIPER REPLACEMENT

Caliper Removal

(1) Raise the vehicle.

(2) Remove the wheel.

(3) Disconnect the brake hose at the caliper (Fig. 20). Retain the fitting bolt but discard the two seal washers.

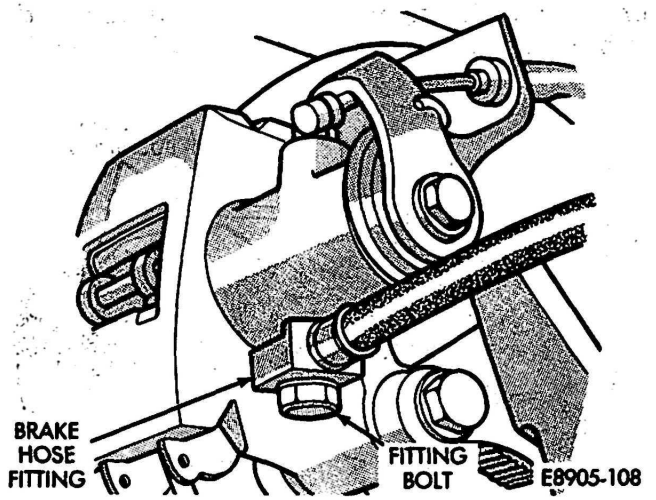


Fig. 20—Rear Brake Hose Attachment

(4) Unseat the operating lever return spring at the caliper (Fig. 4).

(5) Remove the operating lever attaching bolt and pry the lever off the dive disc (Fig. 6).

(6) Remove the lever return spring.
(7) Remove the operating lever from the parking brake cable.
(8) Remove the two slide pins attaching the caliper to the axle shaft and remove the caliper.
(9) Remove the brakeshoe retaining pin and remove the brakeshoes and anti-rattle spring.

Caliper Installation

(1) Install the original or replacement brakeshoes in the new caliper.
(2) Connect the rear brake cable to the caliper operating lever.
(3) Lubricate the caliper slide pins and bushings with silicone lubricant.
(4) Position the replacement caliper over the rotor and on the axle shaft mounting lugs.
(5) Install the caliper slide pins. Tighten the small diameter pin to 28 N·m (21 ft-lbs) torque and the larger diameter pin to 48 N·m (36 ft-lbs) torque.
(6) Position new seal washers on the brake hose fitting and connect the fitting to the caliper. Tighten the fitting bolt to 30 N·m (22 ft-lbs) torque.
(7) Install the wheel and tire.
(8) Lower the vehicle.
(9) Bleed the brakes.

CALIPER BUSHING REPLACEMENT

(1) Remove the caliper as described in the brakeshoe replacement procedure.
(2) Discard the original slide pins.
(3) Remove the brakeshoes.
(4) Push the bushings and boots (Fig. 21) out of the caliper. The bushings are a slip fit and should come out with finger pressure. However, if the bushings are tight, tap them loose with a mallet.

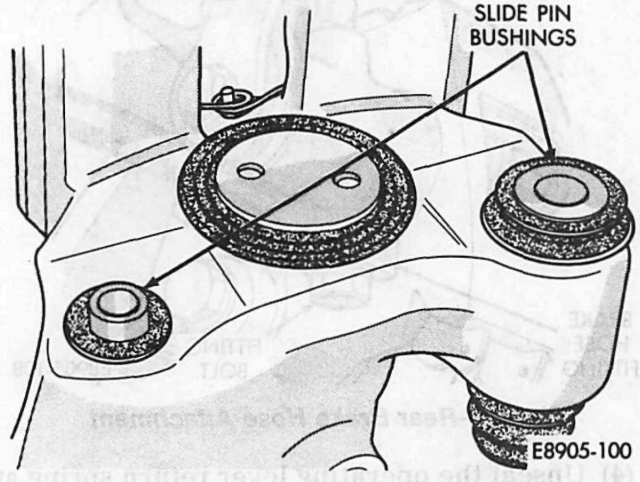


Fig. 21—Slide Pin Bushing Locations

(5) Clean the bushing bores with brake cleaner and a wire brush.
(6) Lubricate the new bushings with silicone lubricant.
(7) Assemble and install the bushings (Fig. 22).

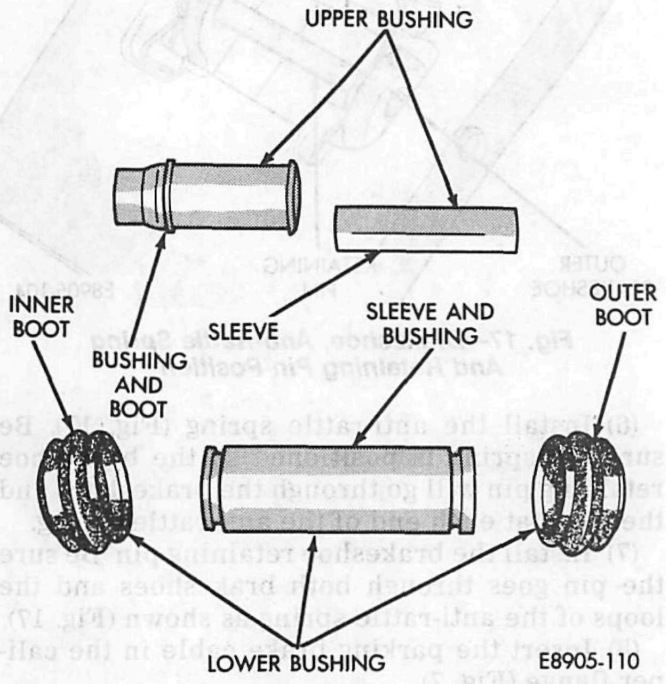


Fig. 22—Slide Pin Bushing Components

(8) If new brakeshoes are being installed, reseat (bottom) the caliper piston. Refer to the Brakeshoe Installation procedure.
(9) Install the brakeshoes, anti-rattle spring and retaining pin (Fig. 17).
(10) Install and secure the caliper with new slide pins.
(11) Install the wheel and lower the vehicle.

ROTOR SERVICE

Rotor Machining

The rear disc brake rotors can be sanded and/or machined to restore surface flatness and finish. However, the rotors should be replaced if the braking surfaces are severely worn, scored, tapered, or out of tolerance.

The "minimum" allowable thickness for the rear disc brake rotor is indicated on the reverse side of the rotor (Fig. 23). The minimum allowable thickness is 9.5 mm (.374 inch). Replace the rotor if worn below this limit or if machining would take the rotor below the stated limit.

The maximum allowable lateral runout for rear rotor is .08 mm (.003 inch). Replace the rotors if runout exceeds this limit.

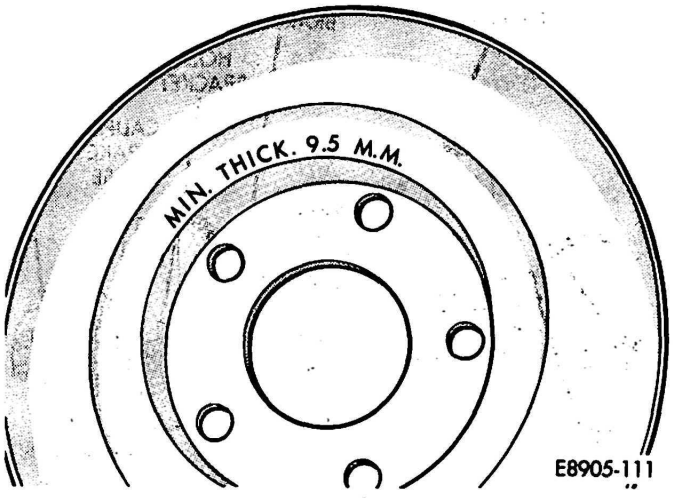


Fig. 23—Location of Rotor Thickness Tolerance

Rotor Removal

(1) Raise the vehicle and remove the rear wheel.

(2) Remove the two slide pins attaching the caliper to the axle shaft.

(3) Lift the caliper up and off the rotor. Secure the caliper to the axle shaft with wire. Do not allow the brake hose to support caliper weight.

(4) Remove the rotor retainers.

(5) Remove the rotor from the axle hub (Fig. 12).

Rotor Replacement

If a new rotor is to be installed, the caliper piston must be reseated (bottomed) in the bore to accommodate the new rotor.

Remove the brakeshoes and reseat the piston only as described in the Brakeshoe Installation procedure.

Rotor Installation

(1) Position the rotor on the axle hub studs.

(2) Install the rotor retainers (Fig. 2).

(3) Install the caliper over the rotor.

(4) Install the caliper slide pins. Tighten the small diameter pin to 28 N·m (21 ft-lbs) torque and the larger diameter pin to 48 N·m (36 ft-lbs) torque.

(5) Install the wheel and lower the vehicle.

(6) Apply the brakes several times to seat the caliper piston.

PARKING BRAKE CABLE SERVICE

Cable Adjustment

The parking brake cable adjustment procedure is the same for all models. Refer to the procedure in "Parking Brake," this group.

Parking Brake Rear Cable Removal

(1) Raise the vehicle.

(2) Loosen the front cable lock nut and adjuster nut. Then disengage the rear cable to be removed from the equalizer (Fig. 24).

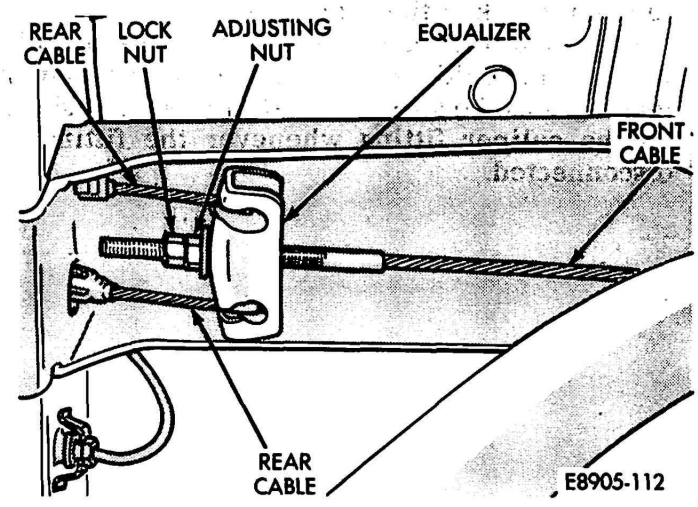


Fig. 24—Parking Brake Cables

(3) Disengage the return spring at the rear caliper (Fig. 4).

(4) Mark operating lever position (Fig. 5).

(5) Remove the operating lever attaching bolt (Fig. 4).

(6) Remove the operating lever.

(7) Disengage the cable from the lever.

(8) Slide the cable out of the caliper.

(9) Remove the cable through the forward end of the body crossmember.

Parking Brake Rear Cable Installation

(1) Insert the cable through the crossmember and route it to the caliper.

(2) Insert the cable into the caliper flange (Fig. 7).

(3) Position the return spring on the caliper.

(4) Install the operating lever on the cable.

(5) Install the operating lever on the caliper drive disc.

(6) Connect the return spring to the caliper and operating lever (Figs. 18 and 19).

(7) Install and tighten the lever attaching bolt.

(8) Engage the cable in the equalizer and adjust the parking brake cable as outlined in Parking Brake section, this group.

REAR BRAKELINES AND HOSES

The rear brakelines and connecting hoses are shown in Figure 25. Rubber hoses connect the metal brakelines to the caliper and brakeline junction block at the rear axle.

The brakelines and hoses are not repairable items and should be replaced when damaged or leaking. Also be sure to install new seal washers on the caliper fitting whenever the fitting is disconnected.

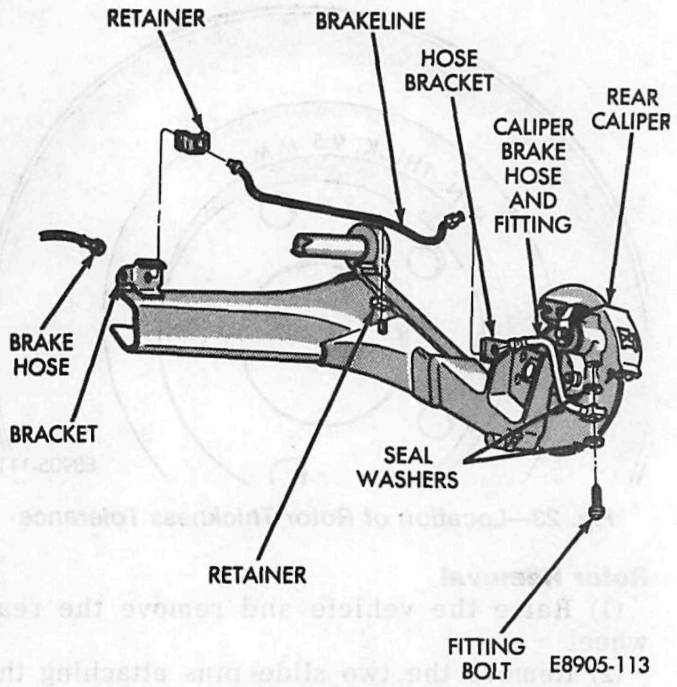


Fig. 25—Rear Brakelines and Hoses

DRUM BRAKE SERVICE

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REAR BRAKE COMPONENTS

The drum brake assemblies are internal expanding, dual shoe, self adjusting units actuated by a wheel cylinder mounted on the backing plate (Fig. 1). The self adjuster mechanism is unique in that a cable is not needed for actuation. Instead, the adjuster lever is mounted on and directly actuated by the secondary shoe (Fig. 1). The brakeshoes are seated against the wheel cylinder pistons at the top and on locating pins at the bottom. The holddown and return springs maintain shoe position.

BRAKE DRUM REMOVAL/INSTALLATION

The rear brake drum can be removed alone or with the axle hub attached. Remove the drum alone if that is the only component to be serviced. Remove the drum and hub as an assembly if the brakeshoes are to be serviced. Separate removal/installation procedures are provided.

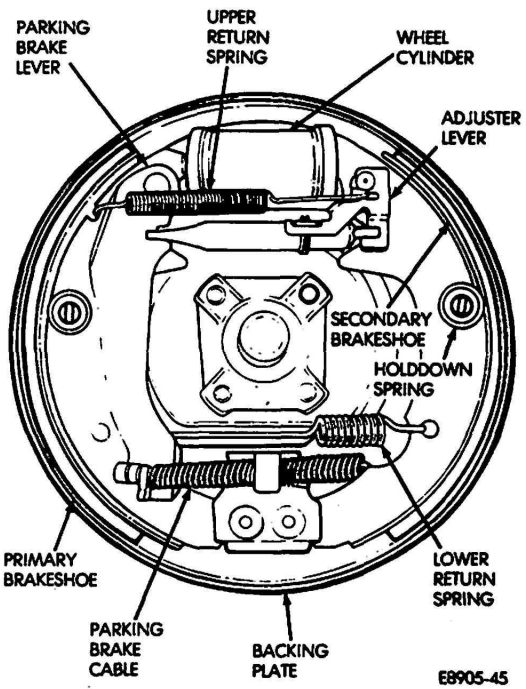


Fig. 1—Drum Brake Components (Right Rear Shown)

Drum (Only) Removal

(1) Raise and support vehicle.
(2) Remove wheel.
(3) Remove the drum retaining nuts if only the drum is to be serviced (Fig. 2).
(4) Remove drum from rear hub.
(5) If drum proves difficult to remove, brakeshoes are probably holding drum in place and must be backed off. Remove access plug from backing plate. Unseat adjuster lever with small screwdriver and back off adjuster screw with brake tool (Fig. 3).

Drum (Only) Installation

(1) Adjust brakeshoes to drum. Refer to procedure in Service Adjustments section.
(2) Install drum on hub.
(3) Install drum retaining nuts.
(4) Install wheel and lower vehicle.

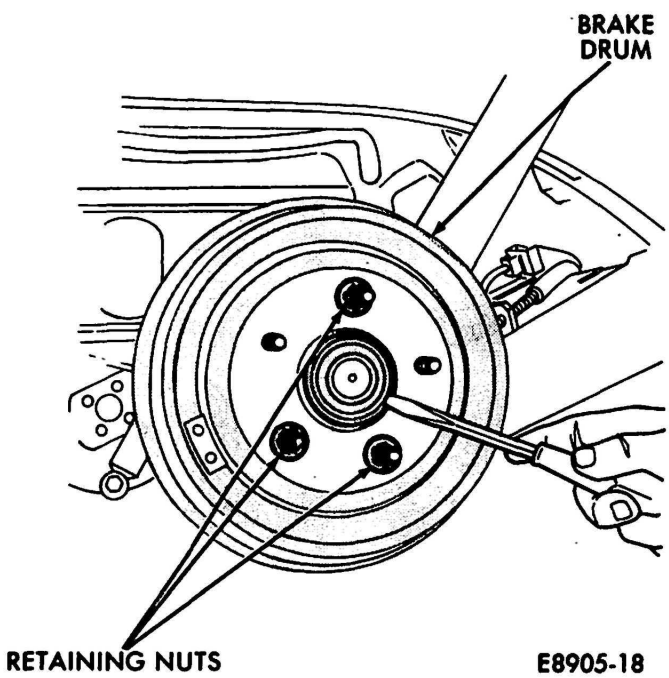


Fig. 2—Removing/Installing Drum Retaining Nuts

Drum and Hub Removal

(1) Raise and support vehicle.
(2) Remove wheel.

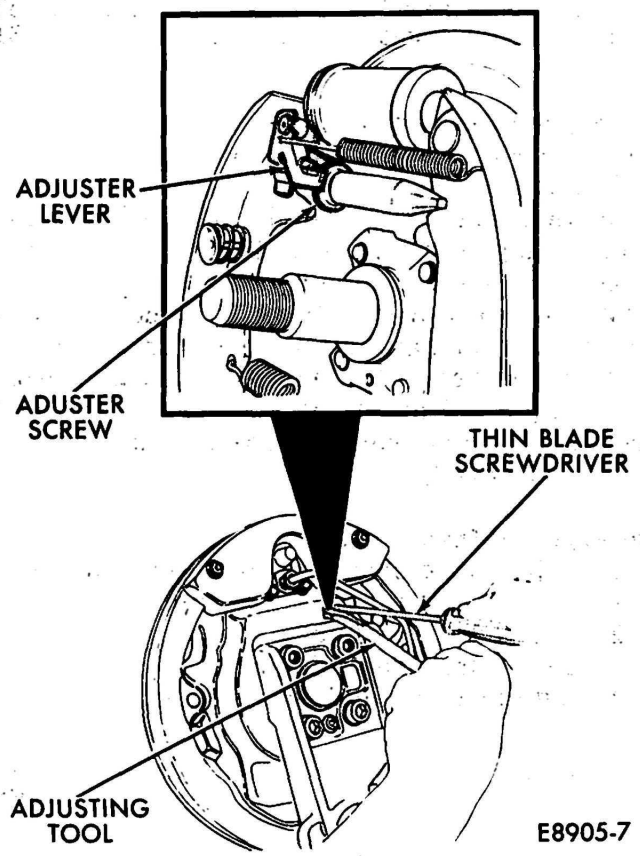


Fig. 3—Backing Off Brakeshoes

(3) Remove hub cap but do not remove drum retaining nuts (Fig. 4).
(4) Remove hub nut (Fig. 4).
(5) If drum proves difficult to remove, brakeshoes are probably holding drum in place and must be backed off. Remove access plug from backing plate. Unseat adjuster lever with small screwdriver and back off adjuster screw with brake tool (Fig. 3).

Drum and Hub Installation

(1) Lubricate axle shaft and hub bearings with bearing grease.
(20 Adjust brake shoes if necessary.
(3) Install drum and hub assembly on axle shaft.
(4) Secure hub and drum to axle shaft with new hub nut. Tighten nut to 167 N·m (123 ft-lbs) torque.
(5) Install cap in hub.
(6) Install wheel and lower vehicle.

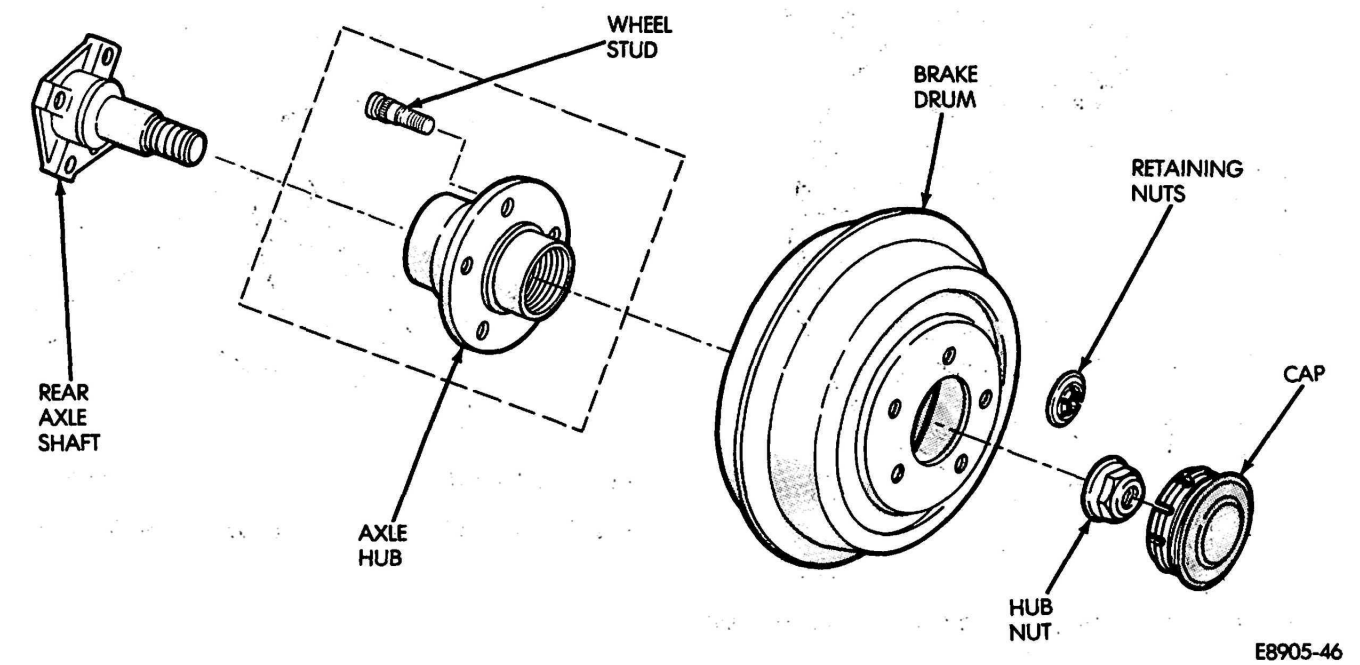


Fig. 4—Brake Drum and Axle Hub Components

BRAKESHOE REPLACEMENT

Brakeshoe Removal

(1) Raise and support vehicle.

(2) Remove wheels.

(3) Remove axle hub and drum as assembly. Refer to procedure in this section.

(4) Remove upper return spring with brake pliers (Fig. 5).

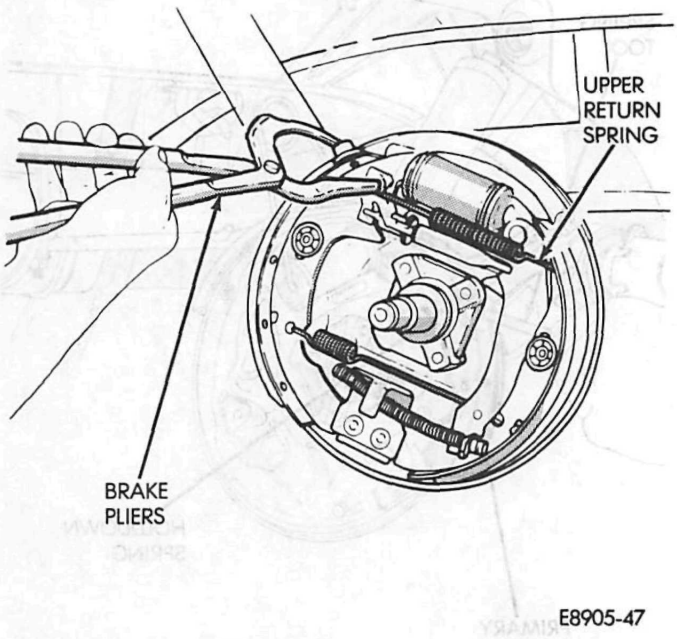


Fig. 5—Removing/Installing Upper Return Spring

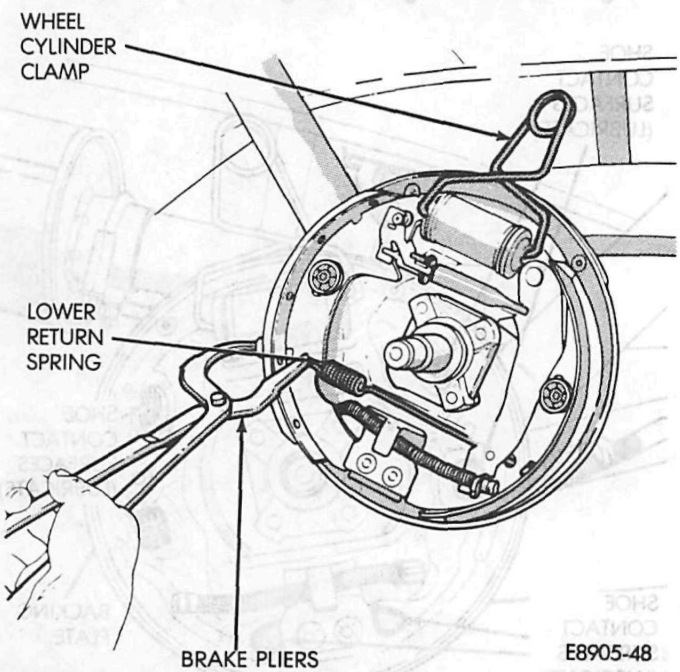


Fig. 6—Removing/Installing Lower Return Spring

(5) Install wheel cylinder clamp to hold pistons in place (Fig. 6).

(6) Remove lower return spring (Fig. 6).

(7) Remove adjuster lever (Fig. 7).

(8) Disengage parking brake cable from lever as follows: Move end of cable away from lever with snap ring pliers. Then disengage cable from lever retainer (Fig. 8).

(9) Remove adjuster screw (Fig. 9).

(10) Remove secondary shoe holddown spring (Fig. 9).

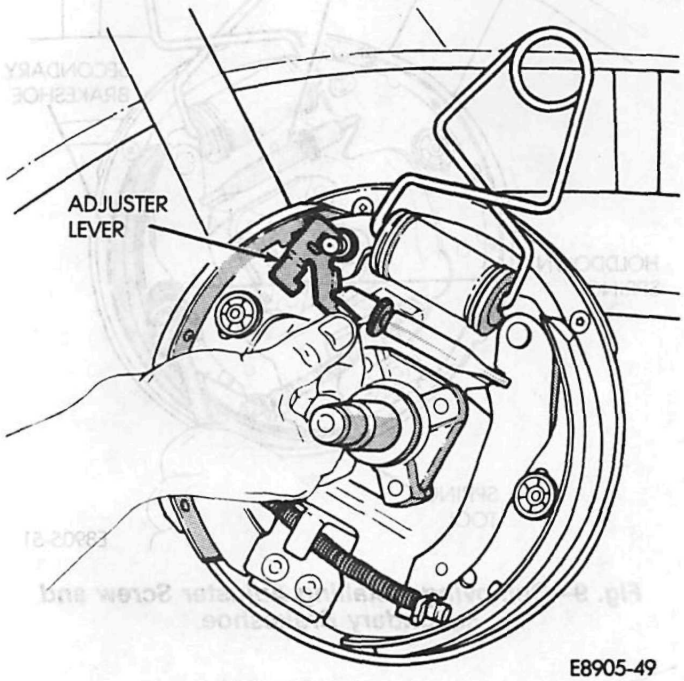


Fig. 7—Removing/Installing Adjuster Lever

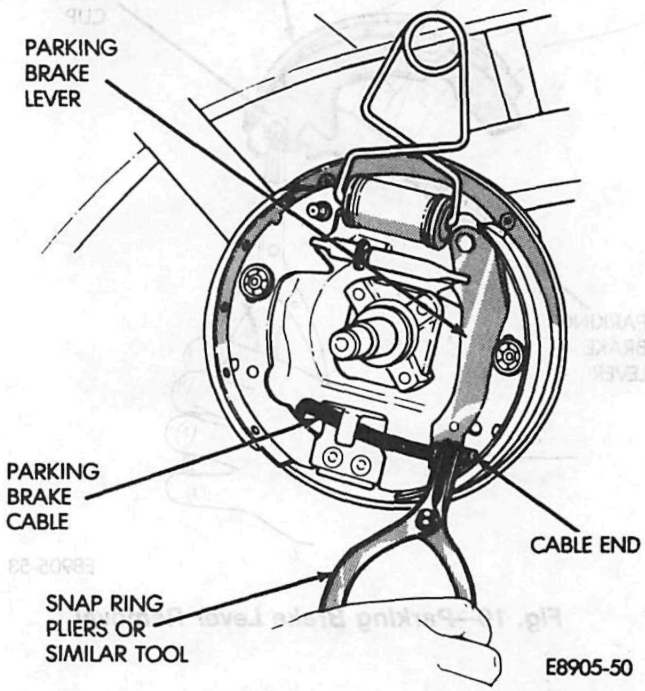


Fig. 8—Removing/Installing Parking Brake Cable

(11) Remove secondary brakeshoe (Fig. 9).

(12) Remove clip attaching parking brake lever to secondary brakeshoe and remove lever from shoe (Fig. 10).

(13) Remove primary shoe holddown spring (Fig. 11).

(14) Remove primary brakeshoe (Fig. 11).

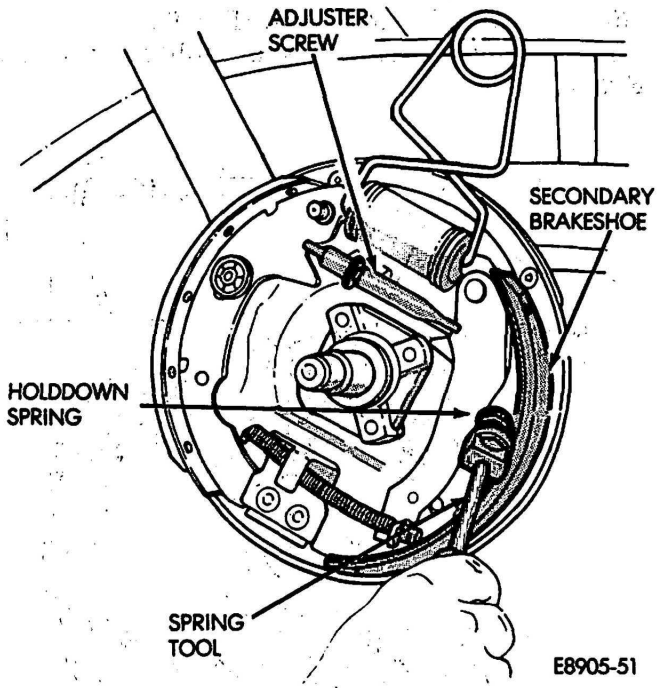


Fig. 9—Removing/Installing Adjuster Screw and Secondary Brakeshoe

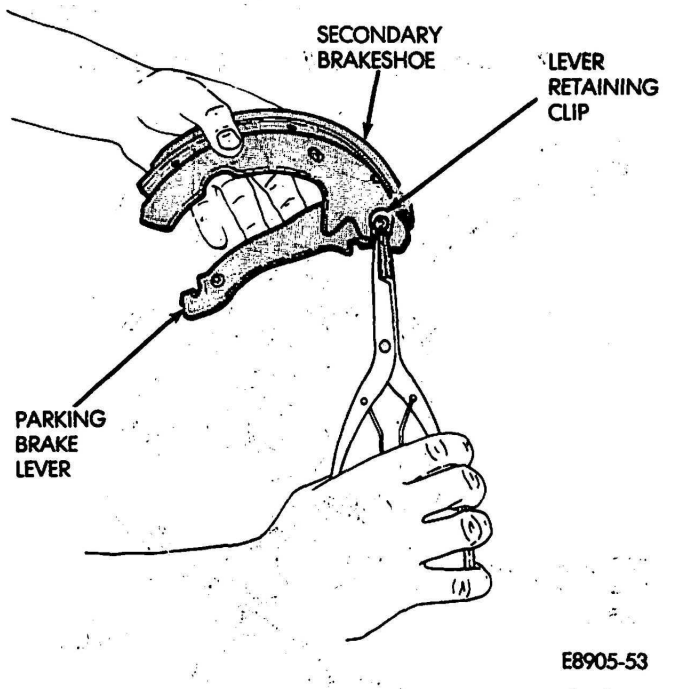


Fig. 10—Parking Brake Lever Removal

Brakeshoe Installation

(1) Clean and lubricate shoe contact surfaces on backing plate with moly grease (Fig. 12).

(2) Lubricate pivot pin of parking brake lever with moly grease (Fig. 13).

(3) Insert parking brake lever pivot in secondary brakeshoe. Install clip on pivot and crimp clip to hold lever in place (Fig. 14).

(4) Attach parking brake cable to lever (Fig. 15).

(5) Position secondary brakeshoe and lever on

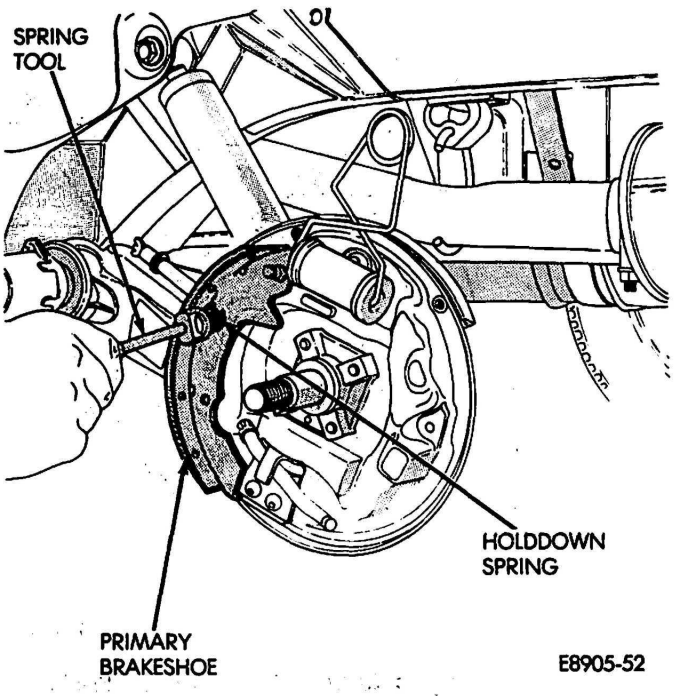


Fig. 11—Removing/Installing Primary Brakeshoe

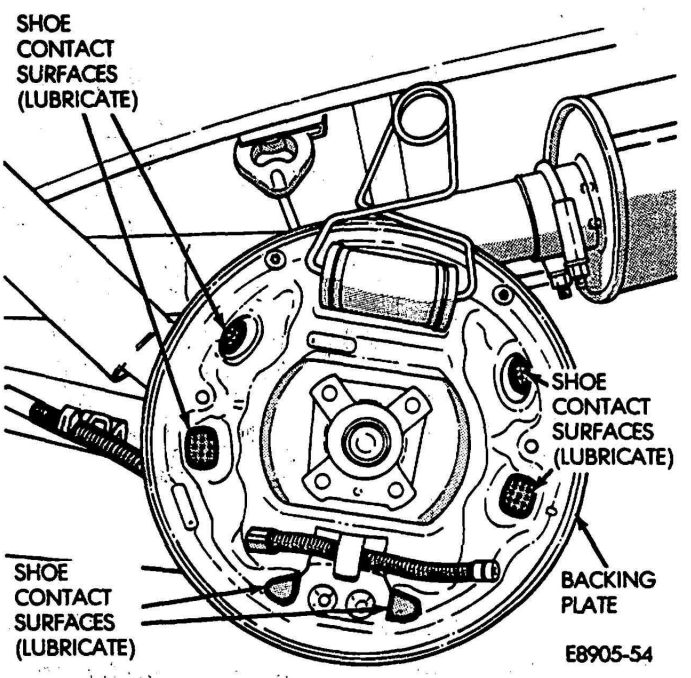


Fig. 12—Backing Plate Contact Surfaces (Lubricate)

backing plate. Secure shoe to plate with new holddown spring and pin (Fig. 9).

(6) Install primary brakeshoe. Secure shoe to plate with new holddown spring and pin (Fig. 11).

(7) Install adjuster screw. Be sure adjuster position is correct. Large notch in adjuster screw goes to brakeshoe. Small notch goes to adjuster lever. Long end goes to secondary brakeshoe (Fig. 16).

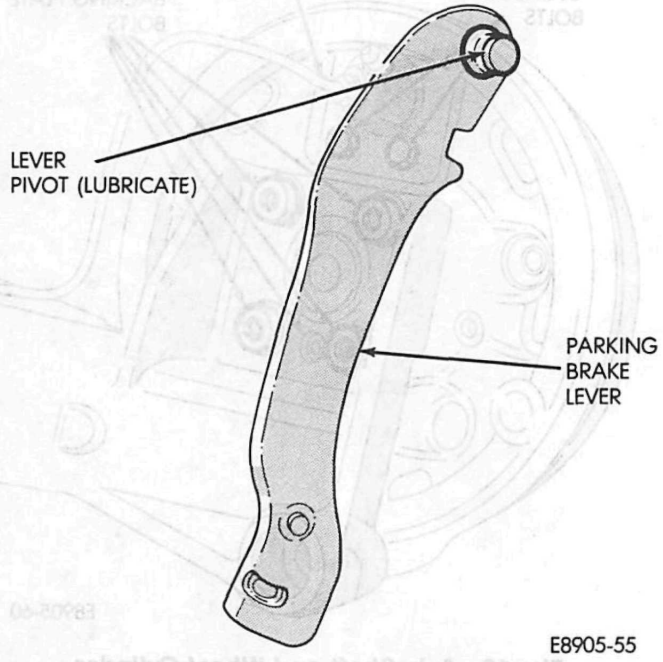


Fig. 13—Parking Brake Lever Pivot (Lubricate)

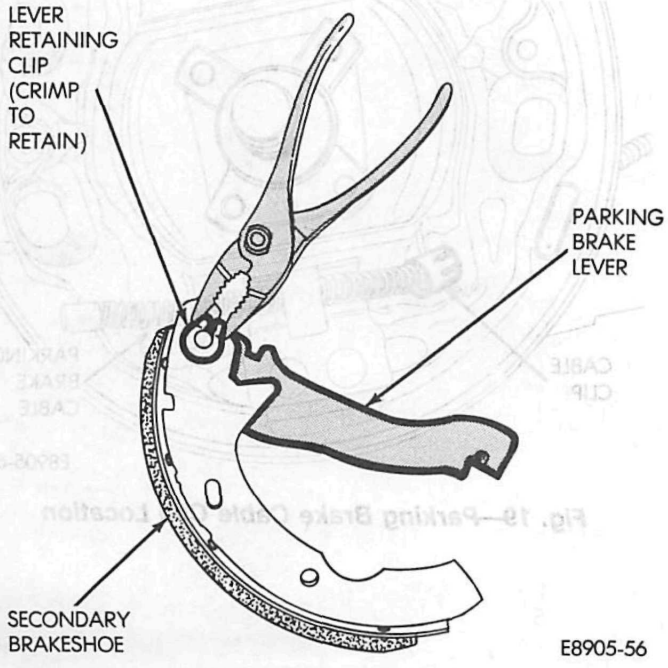


Fig. 14—Installing Lever on Secondary Brakeshoe

(8) Lubricate adjuster lever pin on primary shoe with brake lubricant or moly grease.

(9) Install adjuster lever on primary shoe pin and seat lever in adjuster screw (Fig. 17). Verify that adjuster lever is seated in small notch of adjuster screw (Fig. 16).

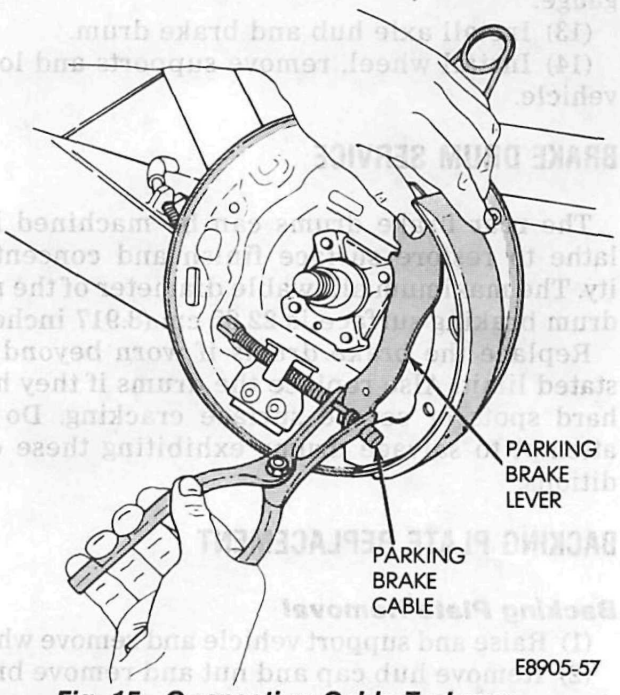


Fig. 15—Connecting Cable To Lever

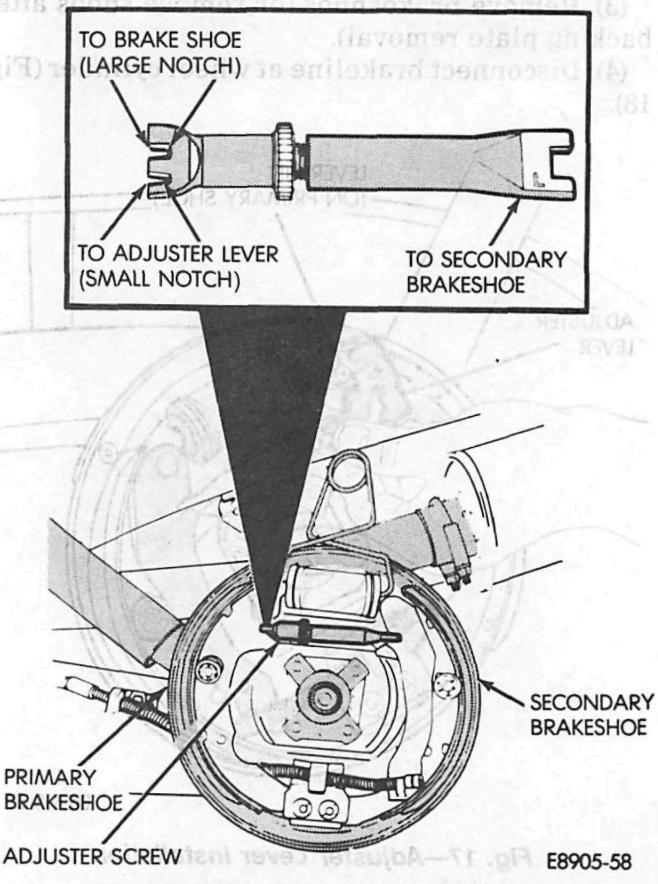


Fig. 16—Adjuster Screw Installation

(10) Install the upper and lower return springs (Figs. 5 and 6).

(11) Verify that brakeshoes are centered on backing plate and seated against wheel cylinder pistons and anchor pins.

(12) Adjust brakeshoes to drum with brake gauge.

(13) Install axle hub and brake drum.

(14) Install wheel, remove supports and lower vehicle.

BRAKE DRUM SERVICE

The rear brake drums can be machined in a lathe to restore surface finish and concentricity. The maximum allowable diameter of the rear drum braking surface is 22.65 cm (8.917 inches).

Replace the brake drums if worn beyond the stated limit. Also replace the drums if they have hard spots or severe surface cracking. Do not attempt to salvage drums exhibiting these conditions.

BACKING PLATE REPLACEMENT

Backing Plate Removal

(1) Raise and support vehicle and remove wheel.

(2) Remove hub cap and nut and remove brake drum and axle hub as assembly.

(3) Remove brakeshoes (or remove shoes after backing plate removal).

(4) Disconnect brakeline at wheel cylinder (Fig. 18).

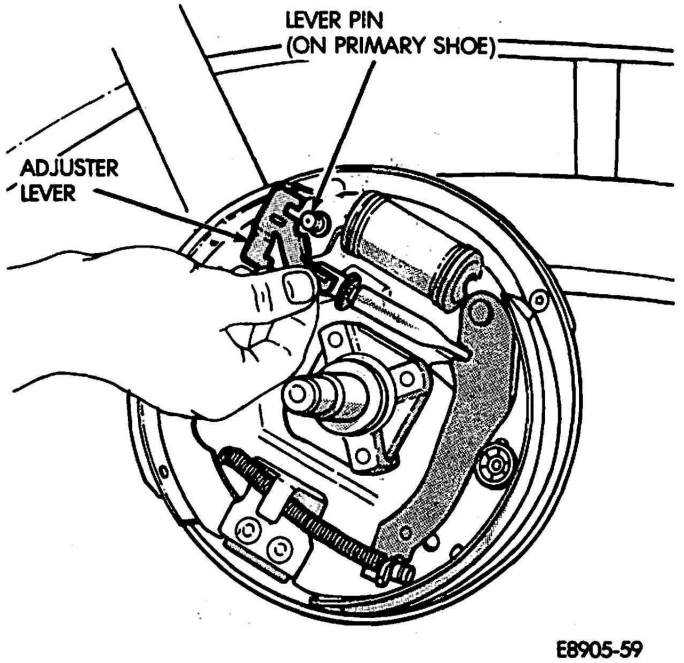


Fig. 17—Adjuster Lever Installation

(5) Remove wheel cylinder bolts and remove cylinder (Fig. 18). Wheel cylinder can also be removed after backing plate is off vehicle.

(6) Remove axle shaft bolts and remove axle shaft (Fig. 18).

(7) Compress parking brake cable clip. Pull cable out of backing plate and remove backing plate.

(8) Remove stiffener plate from backing plate (Fig. 20).

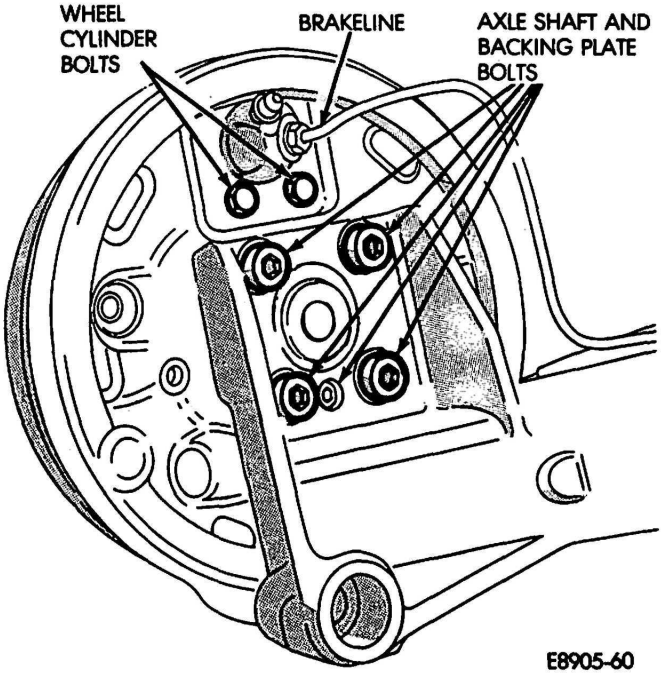


Fig. 18—Axle Shaft and Wheel Cylinder Bolt Locations

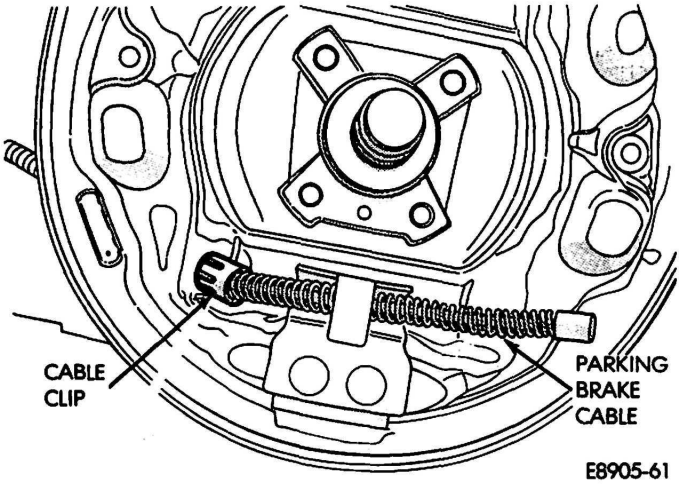


Fig. 19—Parking Brake Cable Clip Location

Backing Plate Installation

(1) Lubricate the brakeshoe contact points on the backing plate with brake lubricant or moly grease.

(2) Install the stiffener plate on the backing plate (Fig. 20). Tighten attaching bolts/nuts to 16 N·m (12 ft-lbs) torque.

(3) The brakeshoes and wheel cylinder can be installed on the backing plate at this time if desired (Fig. 20).

(4) Position backing plate and axle shaft on trailing arm and install attaching bolts (Fig. 20). Tighten bolts to 64 N·m (47 ft-lbs) torque.

(5) Install brakeshoes and wheel cylinder if not previously mounted on backing plate.

(6) Adjust brakeshoes and install brake drum and hub on axle shaft.

(7) Secure hub to axle shaft with new nut (Fig. 20). Tighten nut to 167 N·m (123 ft-lbs) torque.

(8) Install cap in axle hub (Fig. 20).

(9) Bleed brakes.

(10) Install wheel and lower vehicle.

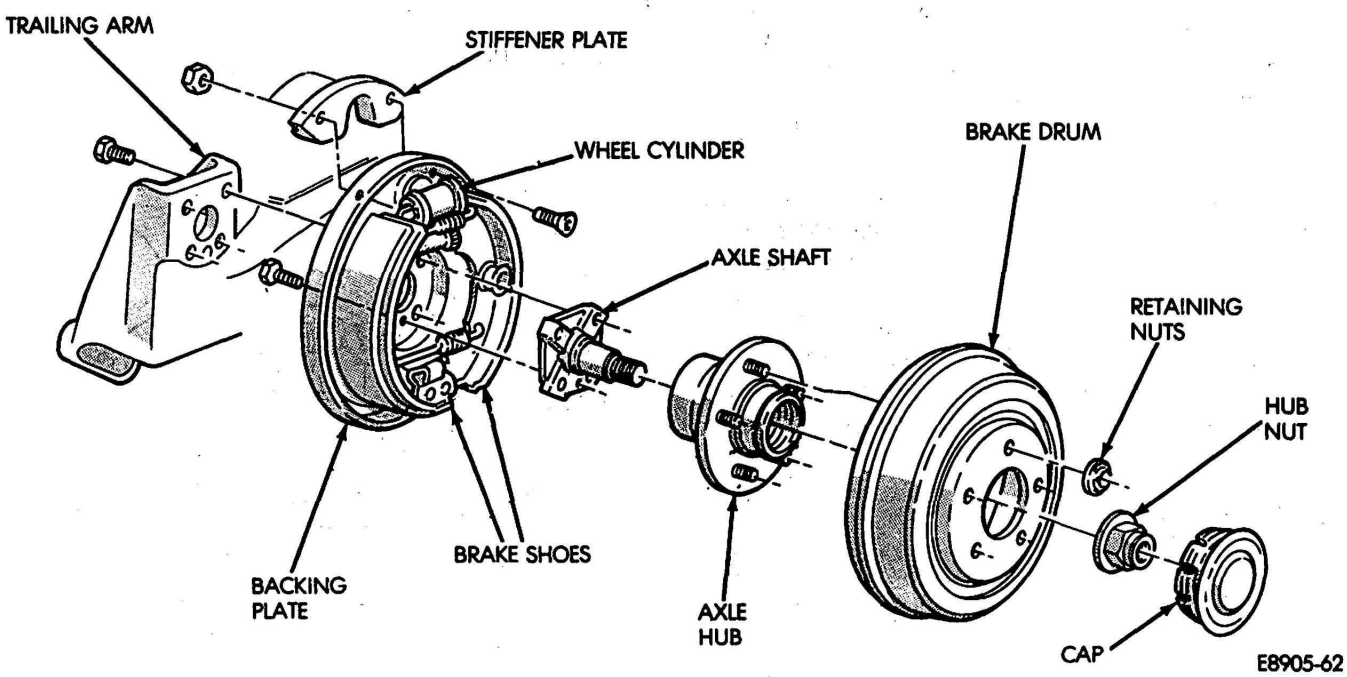


Fig. 20—Backing Plate, Shaft, Hub and Drum Mounting

POWER BOOSTER AND BRAKE PEDAL

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GENERAL SERVICE INFORMATION

The power brake booster is not a serviceable component. The booster must be replaced when diagnosis indicates it has malfunctioned.

The power booster check valve and seal are also not serviceable components. The valve and seal must be replaced if faulty.

The brake pedal and brakelight switch can be removed for service access or for replacement. The brakelight switch is mounted in a bracket attached to the brake pedal support. The switch is not adjustable and must be replaced if faulty.

The brake pedal and the pedal support and bracket can be removed as an assembly for service access or for replacement. A removal/installation procedure is provided in this section.

BOOSTER REMOVAL

(1) Disconnect the battery.

(2) Disconnect booster vacuum hose at booster check valve (Fig. 1).

(3) Remove throttle cable retaining clip and move cable aside for access (Fig. 2).

(4) Disconnect intake hose at air cleaner and throttle body. The move hose aside for access.

(5) Remove master cylinder, proportioning valve and valve bracket. Refer to procedures in Brake Hydraulic System service section.

(6) Remove retaining clip attaching booster push rod to brake pedal (Fig. 3). Discard retaining clip.

(7) Remove nuts attaching booster to brake pedal bracket and dash.

(8) Move brakelines aside and lift booster up and out of engine compartment.

BOOSTER INSTALLATION

(1) If new booster is being installed, transfer check valve, seal and new gasket to booster (Fig. 4).

(2) Verify booster push rod length (Fig. 5). Distance from booster rear face to center of push rod eye should be 98.3-94.6mm (3.87-3.74 inch).

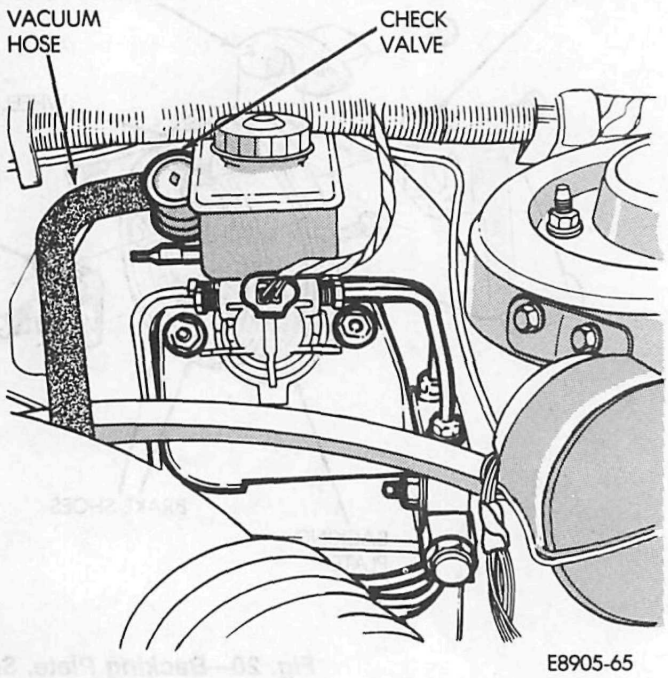


Fig. 1—Booster Vacuum Hose Connection

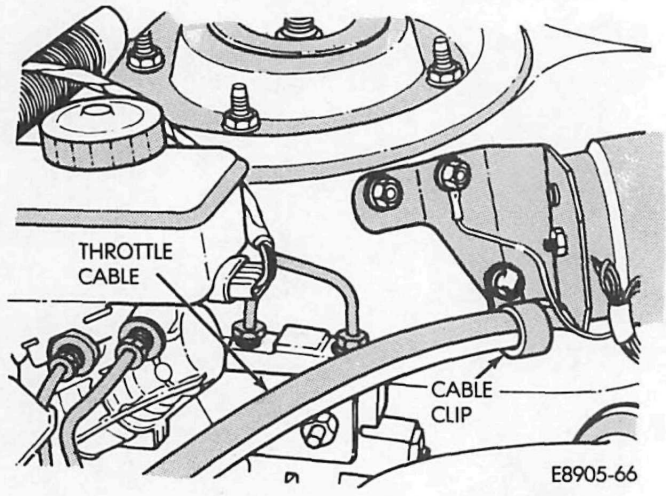


Fig. 2—Throttle Cable Clip Attachment

(3) Position booster on dash and brake pedal bracket.

(4) Align booster push rod with brake pedal. Then install retaining clip (Fig. 3). Use new nuts on the push rod bolt. Do not reuse the old nuts.

(5) Install attaching nuts on booster mounting studs. Tighten nuts to 24 N·m (18 ft-lbs) torque.

(6) Install master cylinder, proportioning valve and valve bracket.

(7) Connect and tighten all brakelines to 15-21 N·m (11-15 ft-lbs).

(8) Install throttle cable clip (Fig. 2).

(9) Install air intake hose on air cleaner.

(10) Bleed brakes.

(11) Connect battery.

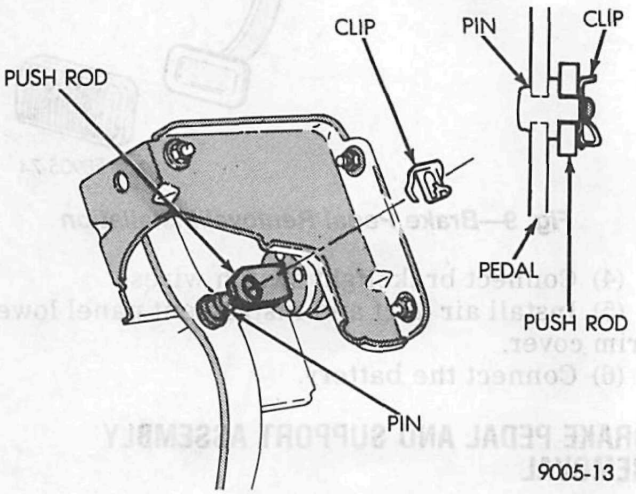


Fig. 3—Booster Push Rod Bolt (With Cruise Control)

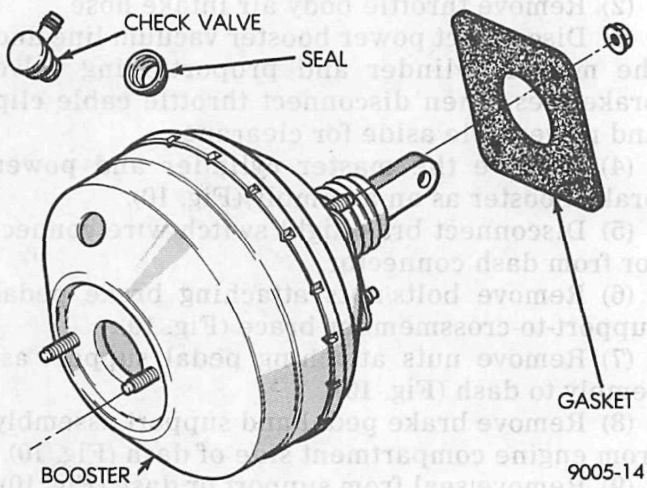


Fig. 4—Booster Components

BRAKE PEDAL REMOVAL

(1) Disconnect the battery.

(2) Slide driver seat fully rearward for working space.

(3) Remove the instrument panel lower trim cover (Figs. 7 and 8).

(4) Remove connecting air duct (Fig. 8).

(5) Disconnect brakelight switch.

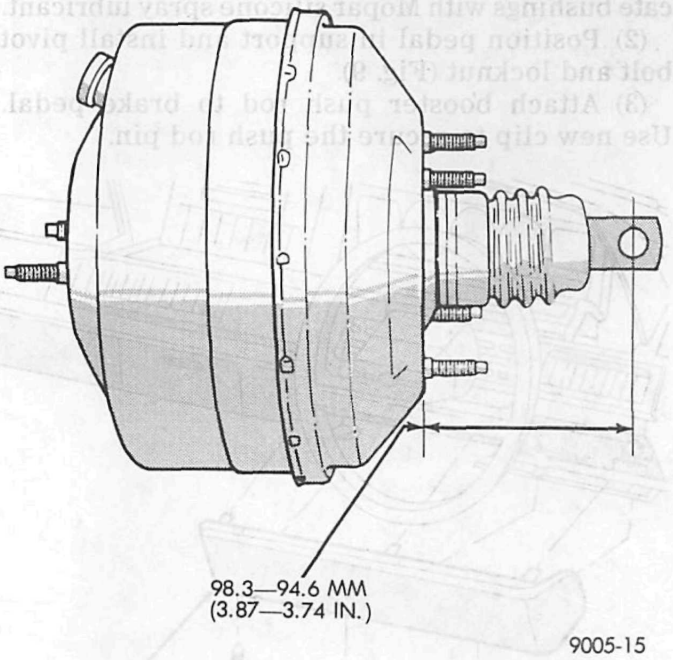


Fig. 5—Booster Push Rod Length

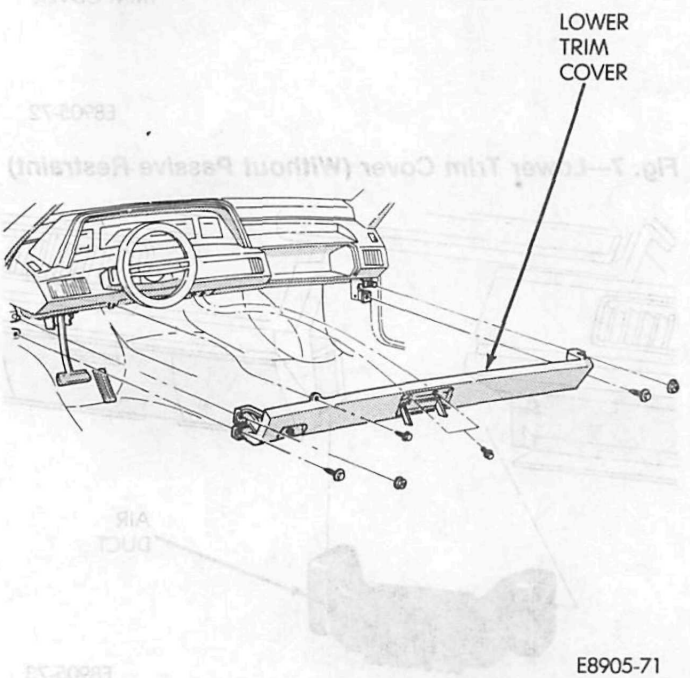


Fig. 6—Lower Trim Cover (With Passive Restraint)

(6) Remove booster push rod retaining clip (Fig. 3). Discard clip. It is not reusable.

(7) Remove brake pedal pivot bolt and nut and remove pedal from support (Fig. 9).

(8) Remove pivot bolt bushings from pedal (Fig. 9).

BRAKE PEDAL INSTALLATION

(1) Install new bushings in pedal (Fig. 9). Lubricate bushings with Mopar silicone spray lubricant.

(2) Position pedal in support and install pivot bolt and locknut (Fig. 9).

(3) Attach booster push rod to brake pedal. Use new clip to secure the push rod pin.

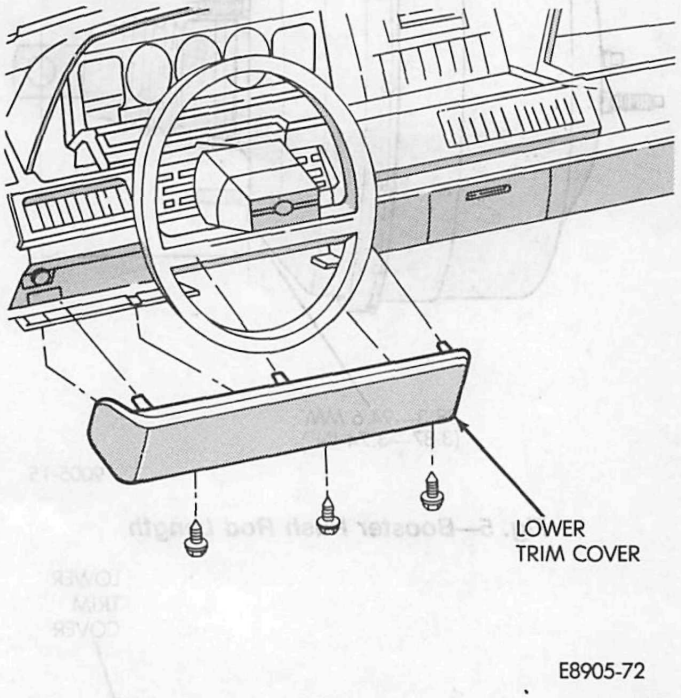


Fig. 7—Lower Trim Cover (Without Passive Restraint)

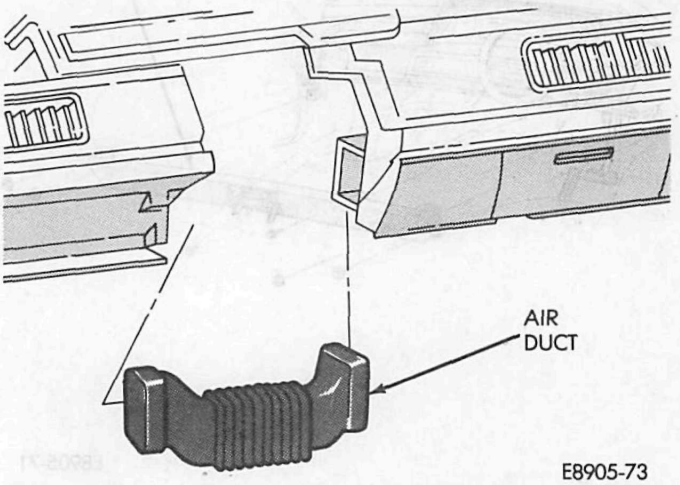


Fig. 8—Removing/Installing Connecting Air Duct

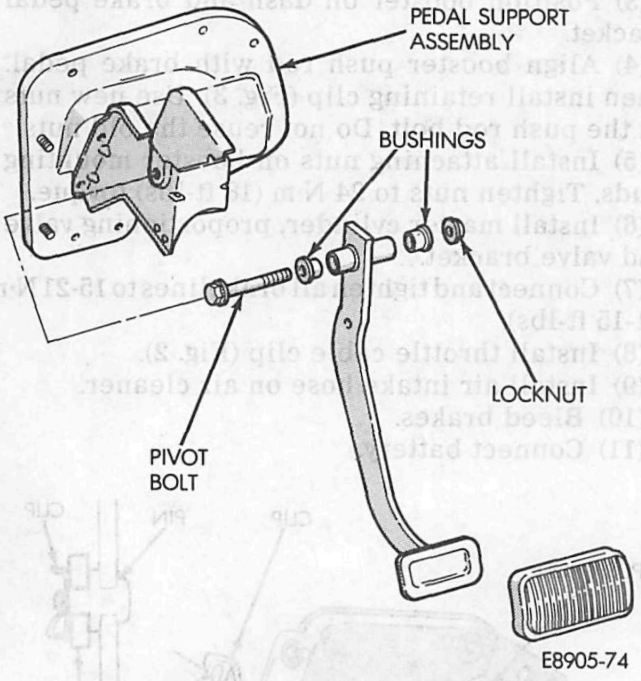


Fig. 9—Brake Pedal Removal/Installation

(4) Connect brakelight switch wires.

(5) Install air duct and instrument panel lower trim cover.

(6) Connect the battery.

BRAKE PEDAL AND SUPPORT ASSEMBLY REMOVAL

(1) Disconnect the battery.

(2) Remove throttle body air intake hose.

(3) Disconnect power booster vacuum line and the master cylinder and proportioning valve brakelines. Then disconnect throttle cable clip and move cable aside for clearance.

(4) Remove the master cylinder and power brake booster as an assembly (Fig. 10).

(5) Disconnect brakelight switch wire connector from dash connector.

(6) Remove bolts/nuts attaching brake pedal support-to-crossmember brace (Fig. 10).

(7) Remove nuts attaching pedal support assembly to dash (Fig. 10).

(8) Remove brake pedal and support assembly from engine compartment side of dash (Fig. 10).

(9) Remove seal from support or dash (Fig. 10).

BRAKE PEDAL AND SUPPORT ASSEMBLY INSTALLATION

(1) Position seal on dash or support (Fig. 10).

(2) Install brake pedal and support assembly on dash.

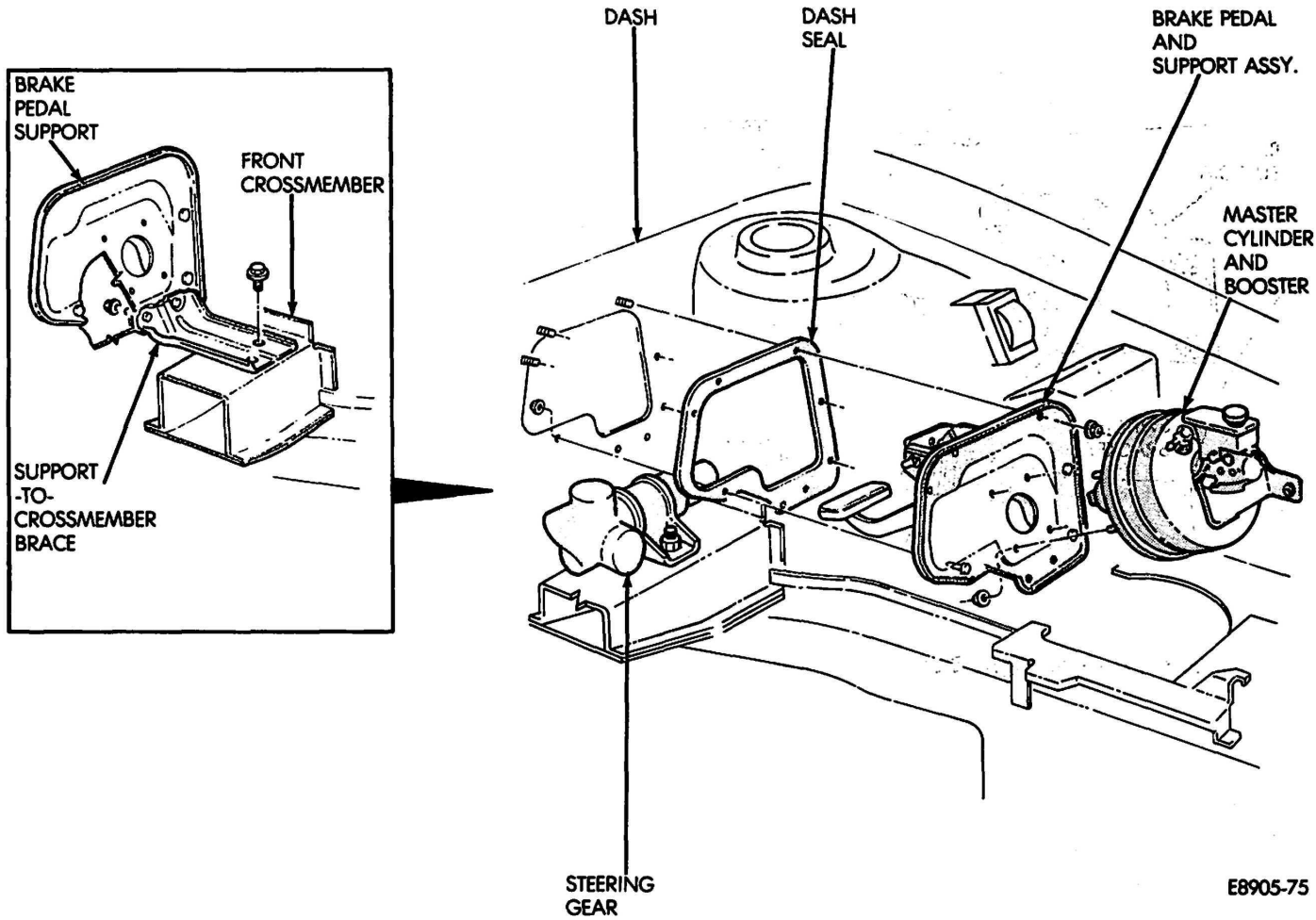


Fig. 10—Brake Pedal and Support Assembly Mounting

(3) Install and tighten support-to-dash attaching nuts to 24 N·m (18 ft-lbs) torque.

(4) Align and install booster and master cylinder on support.

(5) Attach booster push rod to brake pedal (Fig. 3). Be sure to use new retaining clip.

(6) Connect brakelight switch wires.

(7) Connect and tighten brakelines to master cylinder and proportioning valve.

(8) Connect fluid level switch wires to master cylinder.

(9) Install throttle cable locating clip.

(10) Install throttle body air intake hose.

(11) Fill master cylinder reservoir and bleed brakes.

(12) Connect battery.

BRAKELIGHT SWITCH REPLACEMENT

Switch Removal/Installation

On all models (Fig. 11), disconnect the switch wires. Then unseat the switch retainer and remove the switch. To install the switch, hold brake pedal down, insert the switch into a new retainer (be sure to align the tabs on the switch and retainer). Then insert the retainer in the bracket and connect the switch wires. For adjusting, depress brake pedal and push in switch until housing is fully seated against switch bracket, release pedal and (**lightly**) pull up against internal master cylinder stop.

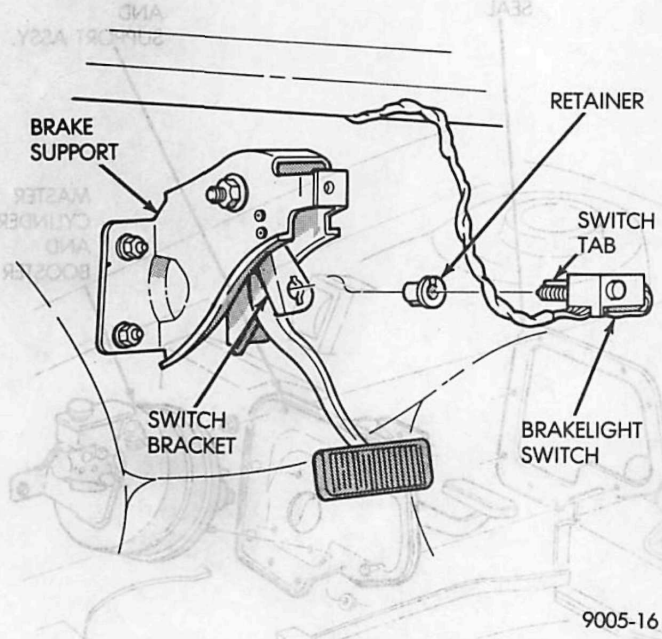


Fig. 11—Brakelight Switch Location

PARKING BRAKE

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PARKING BRAKE PEDAL REMOVAL

(1) Raise the vehicle.

(2) Remove the jam nut and adjusting nut from the front parking brake cable (Fig. 1).

(3) Lower the vehicle.

(4) Disconnect the battery.

(5) Remove the trim cover screws and remove the lower trim cover from instrument panel (Fig. 2).

(6) Remove the release handle screws and disengage the handle from the instrument panel (Fig. 3).

(7) Remove the screws attaching the fuse box to the instrument panel and move the fuse box aside (Fig. 4).

(8) On models with cruise control, remove the cruise control regulator.

(9) Remove the chime module and module mounting bracket.

(10) Disconnect the parking brake warning light wire at the pedal assembly.

(11) Remove the clip that secures the front cable to the pedal assembly (Fig. 5).

(12) Disengage the front cable from the arm on the pedal assembly (Fig. 5).

(13) Remove the nuts attaching the pedal assembly to the cowl (Fig. 5).

(14) Remove the front cable from the pedal arm and remove the pedal assembly and release handle.

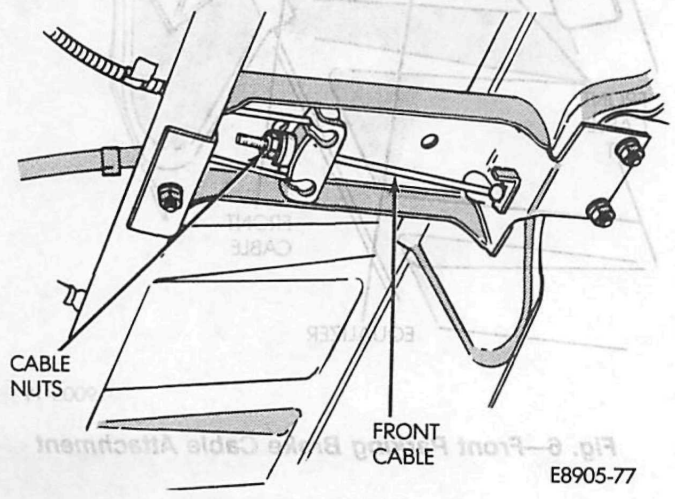


Fig. 1—Removing/Installing Front Cable Nuts

PARKING BRAKE PEDAL INSTALLATION

(1) Install the front cable in the pedal and secure the cable to the pedal arm.

(2) Install the release handle and cable in the pedal if removed.

(3) Install the pedal assembly on the cowl. Tighten the assembly attaching nuts to 27 N·m (20 ft-lbs) torque. Begin with the top front nut and continue tightening in a counter clockwise direction.

(4) Install the front cable clip (Fig. 5).

(5) Connect the parking brake warning light wire to the pedal.

(6) Install the chime module and fuse box.

(7) Attach the release handle to the instrument panel (Fig. 3). Tighten the handle screws to 1.2 N·m (144 in. lbs.) torque.

(8) Install the trim cover on the instrument panel.

(9) Raise the vehicle. Connect the front cable to the equalizer and adjust the parking brake.

(10) Lower the vehicle and connect the battery.

FRONT CABLE REPLACEMENT

(1) Raise the vehicle.

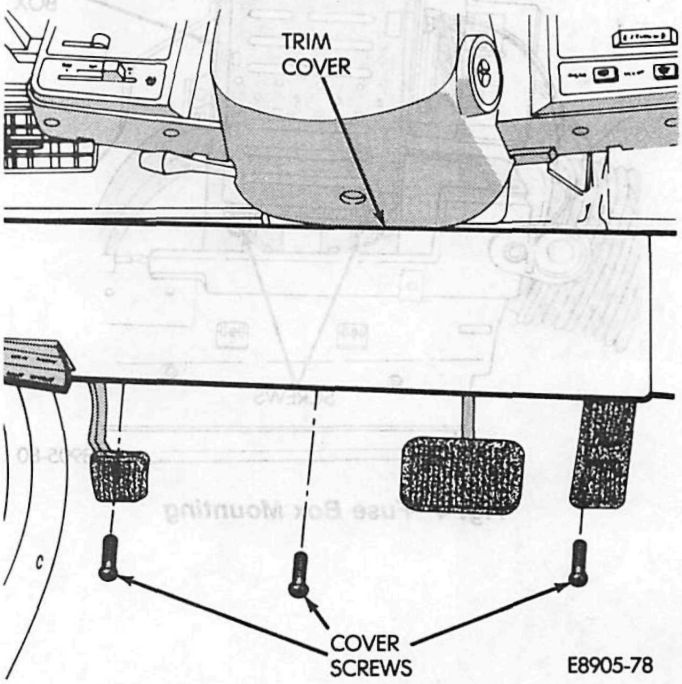


Fig. 2—Removing/Installing Trim Cover

(2) Remove the jam nut and adjusting nut from the front cable (Fig. 6).

(3) Remove the clip securing the front cable to the underbody brace (Fig. 6).

(4) Lower the vehicle.

(5) Remove the sill trim panel at the driver side door (Fig. 7).

(6) Remove the driver seat.

(7) Remove the trim cover on the hood and fuel filler door release levers (Fig. 8).

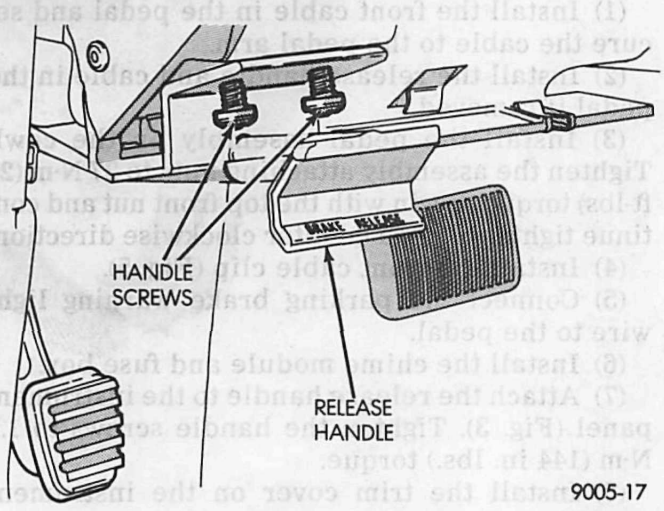


Fig. 3—Removing/Installing Release Handle

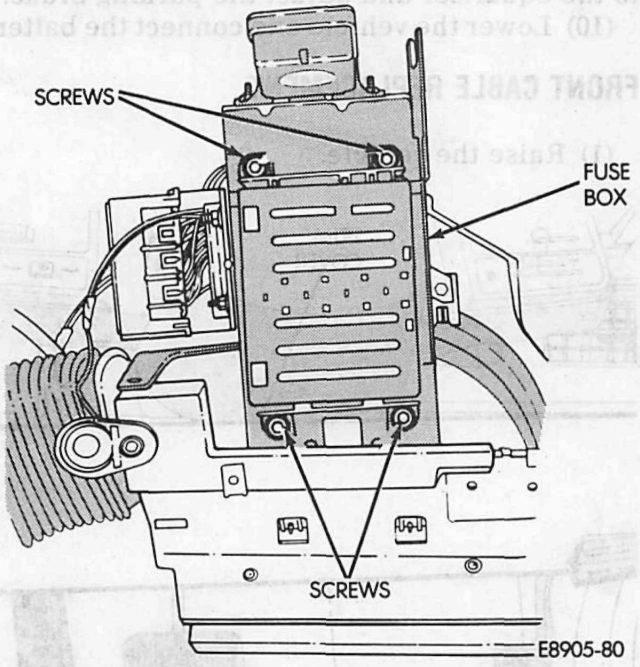


Fig. 4—Fuse Box Mounting

(8) Remove the rear seat cushion.

(9) Roll the carpeting aside for cable access.

(10) Release the cable from the floorpan clips.

(11) Pull the cable through the holes in the floorpan supports and remove the cable (Fig. 8).

FRONT CABLE INSTALLATION

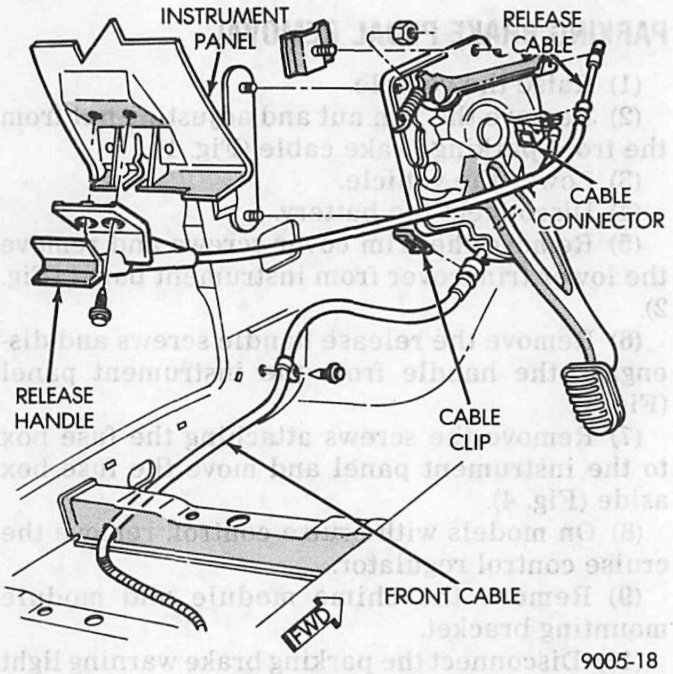


Fig. 5—Parking Brake Pedal Mounting

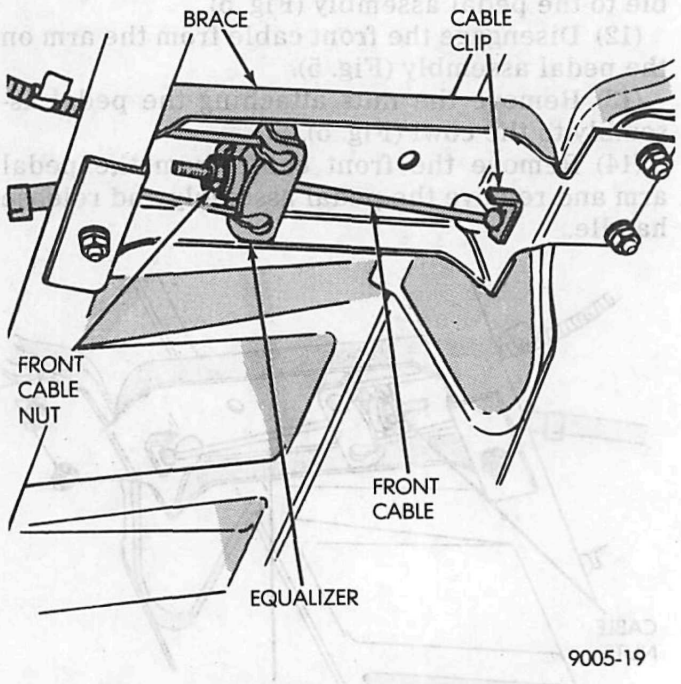


Fig. 6—Front Parking Brake Cable Attachment

(1) Insert the cable through the floorpan supports. Route the cable to the pedal assembly and through the hole exiting at the rear of the passenger compartment (Figs. 5 and 8).

(2) Route the cable to the pedal assembly and attach the cable to the connector on the pedal assembly (Fig. 5).

(3) Install the clip that secures the front cable to the pedal assembly (Fig. 5). Then install the cable in the floorpan clip(s).

(4) Reposition the carpeting and install the sill trim and the hood/fuel filler door release lever trim.

(5) Install the front seat and rear seat cushion.

(6) Install the instrument panel lower trim cover.

(7) Raise the vehicle.

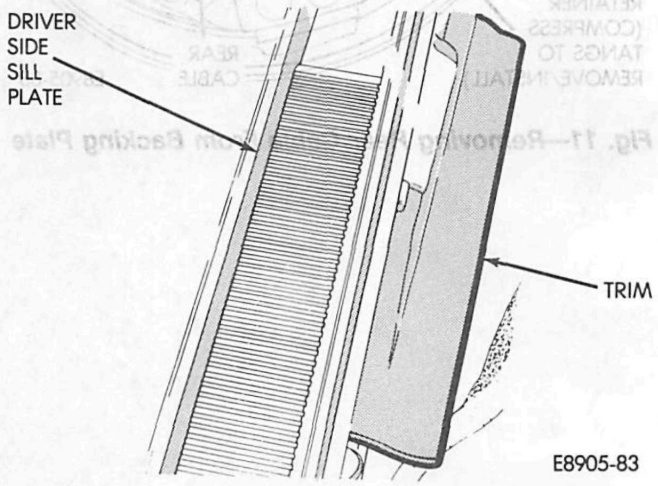


Fig. 7—Removing/Installing Sill Trim

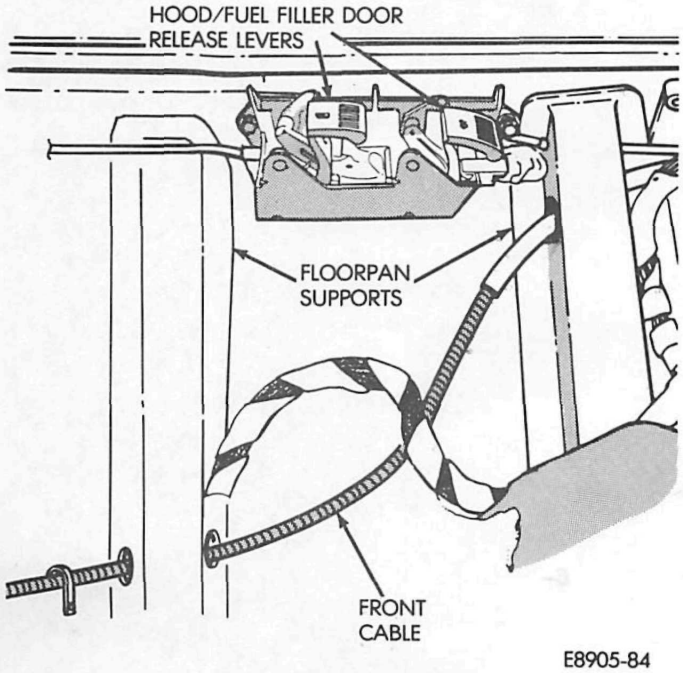


Fig. 8—Front Cable Removal/Installation

(8) Install the clip that secures the front cable to the floorpan and underbody brace (Fig. 6).

(9) Connect the front cable to the equalizer and adjust the cable.

LEFT/RIGHT REAR CABLE REMOVAL

(1) Raise the vehicle and remove the rear wheel(s).

(2) Loosen the jam nut and adjuster nut on the front cable (Fig. 9).

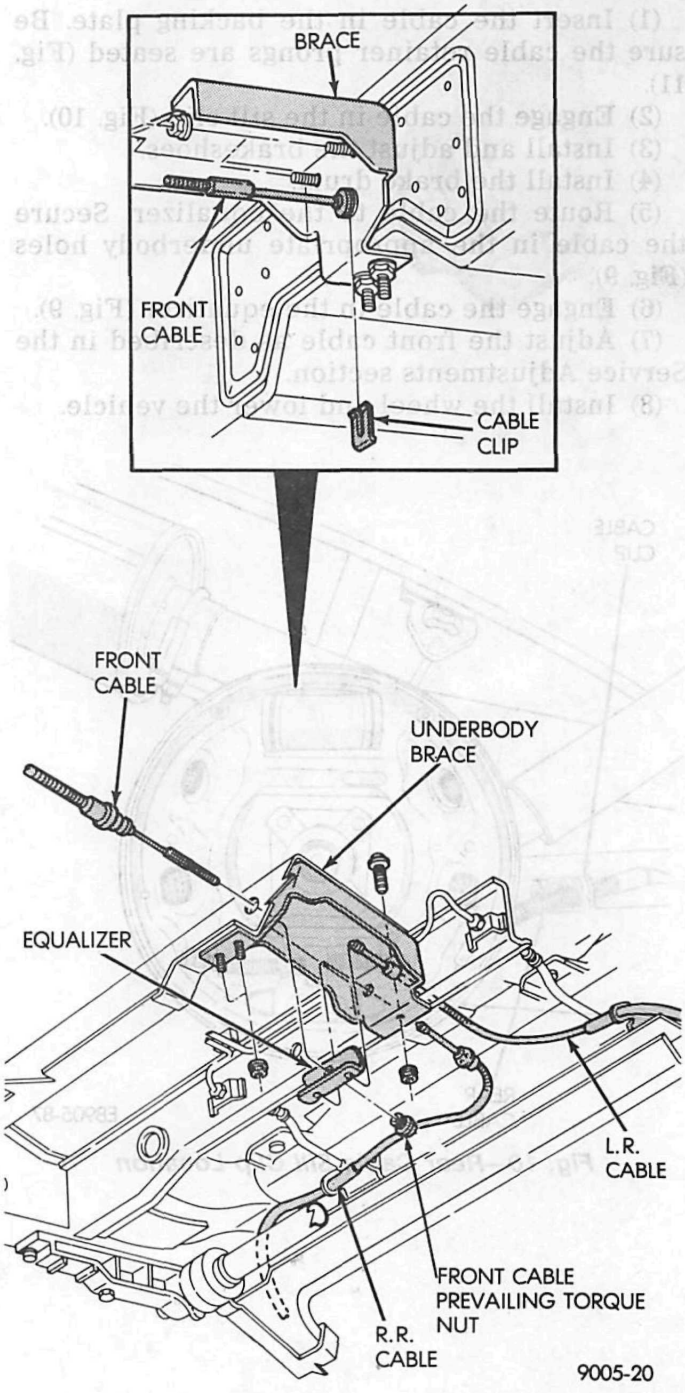


Fig. 9—Parking Brake Rear Cable Attachment

(3) Disengage the rear cable to be serviced at the equalizer (Fig. 9).

(4) Remove the wheel, brake drum and brakeshoes.

(5) Remove the rear cable from the sill clip (Fig. 10).

(6) Compress the cable retainer prongs with a hose clamp or similar device and push the cable out of the backing plate (Fig. 11).

LEFT/RIGHT REAR CABLE INSTALLATION

(1) Insert the cable in the backing plate. Be sure the cable retainer prongs are seated (Fig. 11).

(2) Engage the cable in the sill clip (Fig. 10).

(3) Install and adjust the brakeshoes.

(4) Install the brake drum.

(5) Route the cable to the equalizer. Secure the cable in the appropriate underbody holes (Fig. 9).

(6) Engage the cable in the equalizer (Fig. 9).

(7) Adjust the front cable as described in the Service Adjustments section.

(8) Install the wheel and lower the vehicle.

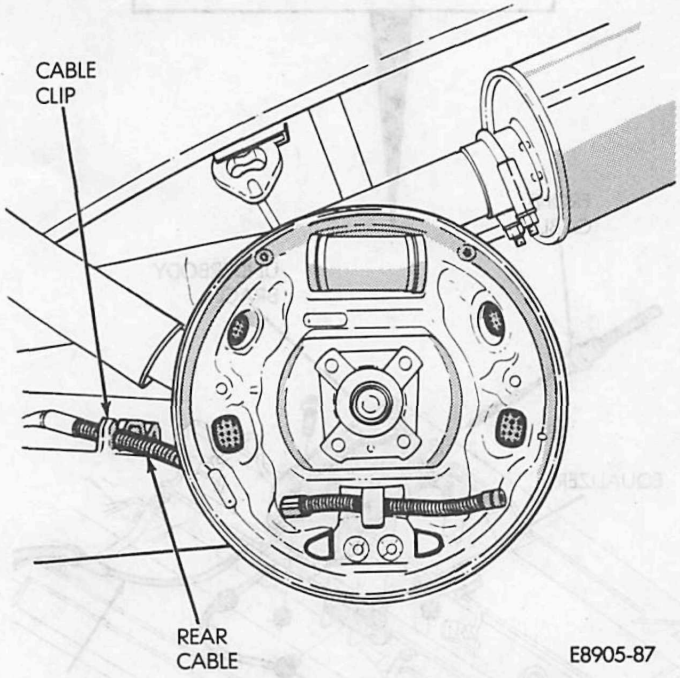


Fig. 10—Rear Cable Sill Clip Location

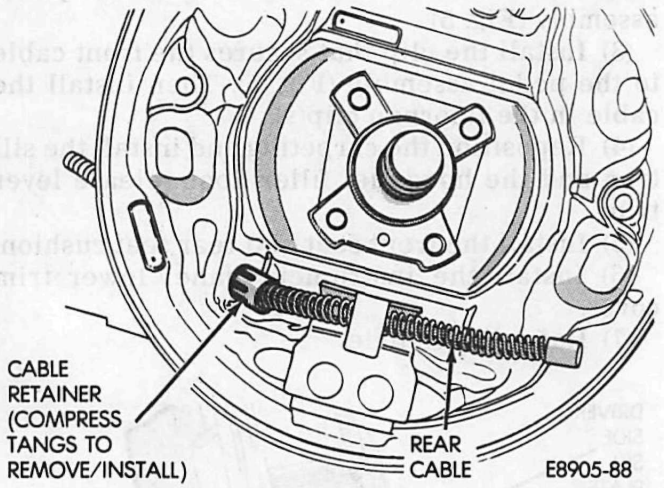


Fig. 11—Removing Rear Cable From Backing Plate

Disc Brake Rotor:	
Diameter	265 mm (10.43 in)
Thickness (New)	22mm (.866 in)
Thickness (Min. Allowable)	20.5 mm (.807 in)
Max. Allowable Runout	.08 mm (.003 in)
Thickness Variation	.02 mm (.001 in)
Caliper Piston Bore Diameter	57 mm (2.244 in)
Wheel Cylinder Bore Diameter	24 mm (.945 in)
Power Booster Diaphragm Diameter	205 mm (8.4 in)
Brake Drum Diameter (New)	225 mm (8.858 in)
Brake Drum Diameter (Max. Allowable)	226.5 mm (8.917 in)
Brakelining Material (Front/Rear)	ORGANIC, NON-ASBESTOS
Brakeshoe And Lining Thickness:	
Front (New)	15.72 mm (.619 in)
Front (Min. Allowable)	6.0 mm (.236 in)
Rear (New)	7.78 mm (.306 in)
Rear (Min. Allowable)	3.36 mm (.132 in)

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COMPONENT	SET-TO TORQUE
Axle Hub Nut	167 N•m (123 ft-lbs)
Brakeline Fittings	15-21 N•m (11-15 ft-lbs)
Brake Pedal Support-To-Dash Nuts	21-27 N•m (15-20 ft-lbs)
Caliper Bracket Bolts	95 N•m (70 ft-lbs)
Caliper Slide Pins	20-30 N•m (15-22 ft-lbs)
Front Brake Hose Fitting Bolt (To Caliper)	20-26 N•m (15-19 ft-lbs)
Front Parking Brake Cable Jam Nut	15-21 N•m (11-15 ft-lbs)
Master Cylinder-To-Booster Nuts	12-18 N•m (9-13 ft-lbs)
Nuts-Brake Pedal Push Rod Bolt:	
Lock Nut	34 N•m (25 ft-lbs)
Jam Nut	8.5 N•m (6 ft-lbs)
Nuts-Brake Pedal Support-To-Brace	34 N•m (25 ft-lbs)
Proportioning Valve Braket Bolt/Nut	5.5 - 8.5 N•m (4-6 ft-lbs)
Power Brake Booster-To-Dash Nuts	24 N•m (18 ft-lbs)
Parking Brake Pedal-To-Cowl Nuts	27 N•m (20 ft-lbs)
Parking Brake Release Cable-To-Dash Screws	1.2 N•m (1 ft-lb)
Rear Axle Shaft-To-Trailing Arm Bolts	64 N•m (47 ft-lbs)
Stiffener Plate Nuts/Bolts	16 N•m (12 ft-lbs)
Wheel Lug Nuts	85 N•m (63 ft-lbs)
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COOLING SYSTEM

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GENERAL INFORMATION

COOLING SYSTEM

The cooling system consists of a radiator, electric cooling fan, water pump, thermostat, coolant pressure bottle, heater core, and hoses. The cooling system regulates the engine operating temperature by allowing the engine to reach normal operating temperature as quickly as possible, maintaining normal operating temperature and preventing overheating.

The cooling system also provides a means of heating the passenger compartment and cooling the automatic transmission fluid. The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system.

The cooling system is pressurized and designed to maintain coolant level to the top of the post located inside the coolant pressure bottle. The radiator does not have a cap. Coolant level checks and cooling system filling is performed at the coolant pressure bottle with the engine cold.

System Coolant Routing

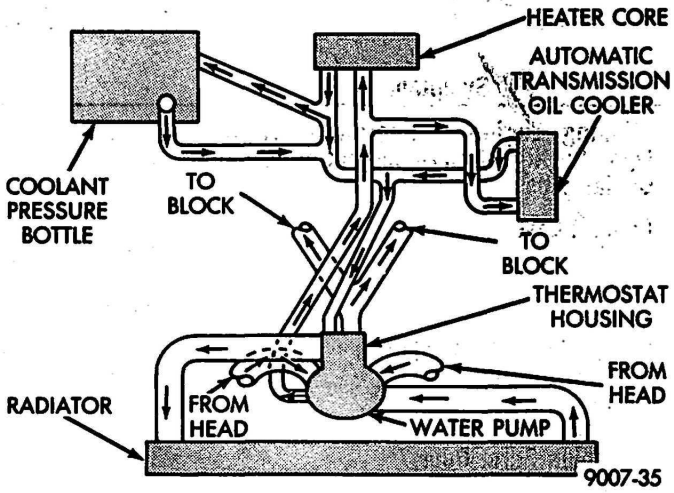


Fig. 1—Cooling System Routing—3.0L Engine with ZF Automatic Transmission

COOLING SYSTEM DIAGNOSIS

Engine Cooling System Overheat Diagnosis

Establish what "driving" conditions caused the complaint. Abnormal loads on the cooling system such as the following may be the cause:

1. PROLONGED IDLE, VERY HIGH AMBIENT TEMPERATURE, SLIGHT TAIL WIND AT IDLE, SLOW TRAFFIC, TRAFFIC JAMS, HIGH SPEED, STEEP GRADES:

Idle with A/C off when temperature gauge is at end of normal range.

2. TRAILER TOWING:

Consult owner's manual—Trailer Towing. Do not exceed limits.

3. RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on the vehicle that may affect the cooling system such as: engine adjustments (incorrect timing), slipping accessory drive belt(s), brakes (possibly dragging), changed parts (incorrect water pump—rotating in wrong direction), recorded radiator or cooling system refilling (possibly under filled or trapped air).

If investigation reveals none of the above as a cause for engine overheating complaint, refer to the following symptom and action chart.

SYMPTOM and ACTION

Symptom	Action
Blinking Engine Temperature Warning Light Or High Gauge Indication-Without Coolant Loss	Normal with temporary operation with heavy load, towing a trailer, high outdoor temperatures, and/or on a steep grade.
Coolant Loss	Improper refilling procedures can result in trapped air in the system. Subsequent operation of the pressure cap will deareate the cooling system. A low coolant level will then result in the Coolant Pressure Bottle. Add coolant. If condition persists see System Diagnosis.
Hot Vehicle (Not Engine) Heat Damage, Hot Carpet, Seat, Hot Catalytic Converter, Smoke, Burnt Odor	Check heat shielding, exhaust system, engine emission controls, ignition timing, engine misfiring.
Hot Engine Crackling Noise Hot Smell Severe Local Hot Spots	A moderate amount of sound from heating metal can be expected with any vehicle. However, a crackling sound from the thermostat housing, a hot smell and/or severe local hot spots on an engine can indicate blocked coolant passages, bad casting, core sand deposits and subsequent blockage, cracked cylinder block or head, or blown cylinder head gasket.
Coolant Pressure Bottle Level Changes	Level changes are to be expected as coolant volume fluctuates with engine temperature. During operation at higher temperatures and/or under heavy loads the coolant level in the pressure bottle may increase above the top of the post inside the bottle. Coolant level should return between the top of the post and the minimum mark on the post when the engine returns to normal operating temperature.
Cooling Fan Never Runs	Consult Inoperative Auxiliary Cooling Fan section of this group.
Cooling Fan	The Fan will run when the air conditioning compressor is engaged regardless of coolant temperature.

CONDITION	POSSIBLE CAUSE	CORRECTION
NOISE	(1) Fan contacting shroud.	(1) Reposition shroud and inspect engine mounts.
	(2) Loose water pump impeller.	(2) Replace pump.
	(3) Glazed accessory drive belt.	(3) Replace belt.
	(4) Loose accessory drive belt.	(4) Adjust accessory belt tension.
	(5) Rough surface on drive pulley.	(5) Replace pulley.
	(6) Water pump bearing worn.	(6) Remove belt to isolate. Replace pump.
	(7) Belt alignment.	(7) Check pulley alignment. Repair as necessary.
	(8) Coolant on belt.	(8) Clean belt with water.
COOLANT LOSS - BOILOVER	**Refer to Overheating Causes in addition to the following items.**	
	(1) Overfilled cooling system.	(1) Reduce coolant level to proper specification.
	(2) Quick shutdown after hard (hot) run.	(2) Allow engine to run at fast idle prior to shutdown.
	(3) Air in system resulting in occasional "burping of coolant.	(3) Purge system.
	(4) Insufficient antifreeze allowing coolant boiling point to be too low.	(4) Add antifreeze to raise boiling point.
	(5) To much antifreeze in coolant mixture.	(5) Replace coolant with 50/50 mix of antifreeze and water.
	(6) Antifreeze deteriorated because of age or contamination.	(6) Replace coolant.
	(7) Leaks due to loose hose clamps, loose nuts, bolts, drain plugs, faulty hoses, or defective radiator.	(7) Pressure test system to locate source of leak(s), then repair as necessary.
	(8) Faulty head gasket.	(8) Replace head gasket.
	(9) Cracked head, manifold, or block.	(9) Replace as necessary.
	(10) Faulty pressure cap on pressure bottle.	(10) Replace cap.
	(11) Restricted radiator core.	(11) Remove restriction.
	(12) Faulty thermostat.	(12) Replace thermostat.
COOLANT ENTRY INTO CRANKCASE OR CYLINDER(S)	(1) Low cylinder head bolt torque.	(1) Replace gasket retorque head.
	(2) Faulty head gasket.	(2) Replace head gasket.
	(3) Crack in head, manifold or block.	(3) Replace as necessary.
NO COOLANT FLOW THROUGH HEATER CORE	(1) Restricted return inlet in water pump.	(1) Remove restriction.
	(2) Heater hose collapsed or restricted.	(2) Remove restriction or replace hose.
	(3) Restricted heater core.	(3) Remove restriction or replace core.
	(4) Restricted outlet in thermostat housing.	(4) Remove flash or restriction.
	(5) Intake manifold bypass hole in cylinder head restricted.	(5) Remove restriction.

CONDITION	POSSIBLE CAUSE	CORRECTION
HIGH TEMPERATURE GAUGE INDICATION	(1) Coolant level low.	(1) Replenish coolant.
	(2) Accessory drive belt loose.	(2) Adjust accessory drive belt tension.
	(3) Radiator hose(s) collapsed.	(3) Replace hose(s).
	(4) Radiator airflow blocked.	(4) Remove restriction (bug screen fog lamps, etc.).
	(5) Faulty coolant pressure bottle cap.	(5) Replace coolant pressure bottle cap.
	(6) Air trapped in cooling system.	(6) Purge air.
	(7) Heavy traffic driving.	(7) Leave traffic. Stop vehicle. Turn A/C off. Allow engine to cool.
	(8) Incorrect cooling system component(s) installed.	(8) Install proper component(s).
	(9) Faulty thermostat.	(9) Replace thermostat.
	(10) Water pump shaft broken or impeller loose.	(10) Replace water pump.
	(11) Radiator tubes clogged.	(11) Flush radiator.
	(12) Cooling system clogged.	(12) Flush system.
	(13) Casting flash in cooling passages.	(13) Repair or replace as necessary. Flash may be visible by removing cooling system components or removing core plugs.
	(14) Brakes dragging.	(14) Repair brakes.
	(15) Excessive engine friction.	(15) Repair engine.
	(16) Antifreeze concentration over 50%.	(16) Lower antifreeze concentration percentage to 50%.
	(17) Faulty gauge or sending unit.	(17) Repair or replace component.
	(18) Loss of coolant flow caused by leakage or foaming.	(18) Repair or replace leaking component, replace coolant.
	(19) Faulty cooling fan operation.	(19) Check cooling fan operation.
LOW TEMPERATURE INDICATION	(1) Thermostat stuck open.	(1) Repair or replace faulty component.
	(2) Faulty gauge or sending unit.	(2) Repair or replace faulty component.

SERVICE PROCEDURES

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WATER PUMP

A centrifugal water pump circulates the coolant through the water jackets, passages, radiator core, cooling system hoses and heater core (Fig. 1). The pump is driven from the engine crankshaft by a serpentine drive belt.

The water pump impeller is pressed onto the rear of a shaft that rotates in bearings pressed into the housing. The housing has a small hole to allow seepage to escape. The water pump seals are lubricated by the antifreeze in the coolant mixture. No additional lubrication is necessary.

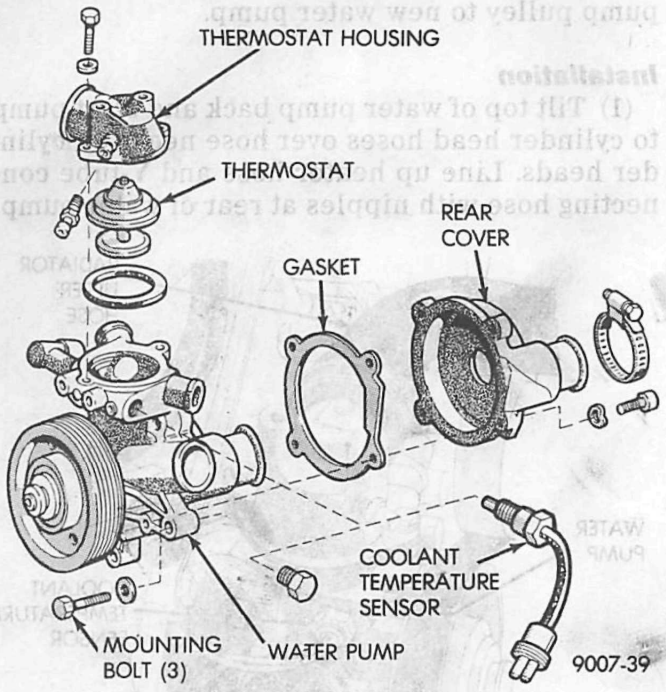


Fig. 1—Water Pump—3.0L Engine

Removal—3.0L Engine

CAUTION: When servicing the coolant system, it is essential that coolant does not drip onto the accessory drive belt and/or pulleys. Protect the belt with clean, dry shop towels before servicing the cooling system. If coolant contact belt or pulleys, flush them with clean water.

If the water pump pulley is also being replaced (or reused), remove the pulley with the old water pump mounted to the engine and install the pulley with the replacement water pump mounted to the engine. Install the lower mounting bolt before installing the replacement pulley. The lower bolt cannot be installed with the pulley pressed onto the water pump shaft.

(1) Disconnect battery negative cable from battery.

(2) Loosen accessory drive belt. Refer to Accessory Drive Belt section of this group.

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR COOLANT PRESSURE BOTTLE CAP, OR LOOSEN THE RADIATOR DRAINCOCK, WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

(3) Attach one end of a 6.35 mm (¼ in) ID hose that is approximately 914 mm (36 in) long, to radiator drain (Fig. 2). Place the other end of the hose in a clean container.

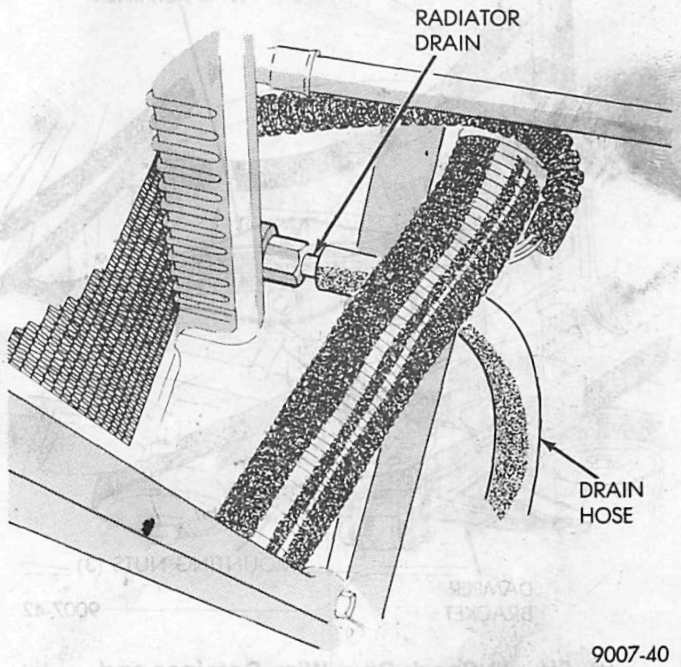


Fig. 2—Radiator Drain and Drain Hose

(4) Open radiator drain.

(5) Remove coolant pressure bottle cap (Fig. 3) and let radiator drain.

(6) Remove engine cover.

(7) Remove spark plug wire retainer from top of thermostat housing (Fig. 4).

(8) Remove front damper mounting bracket nuts. Push bracket towards radiator but do not contact radiator fins.

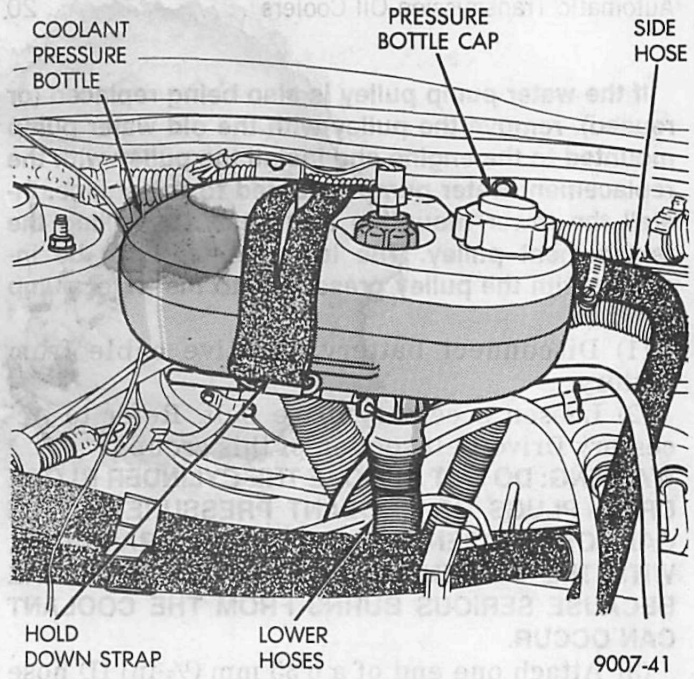


Fig. 3—Coolant pressure bottle Cap

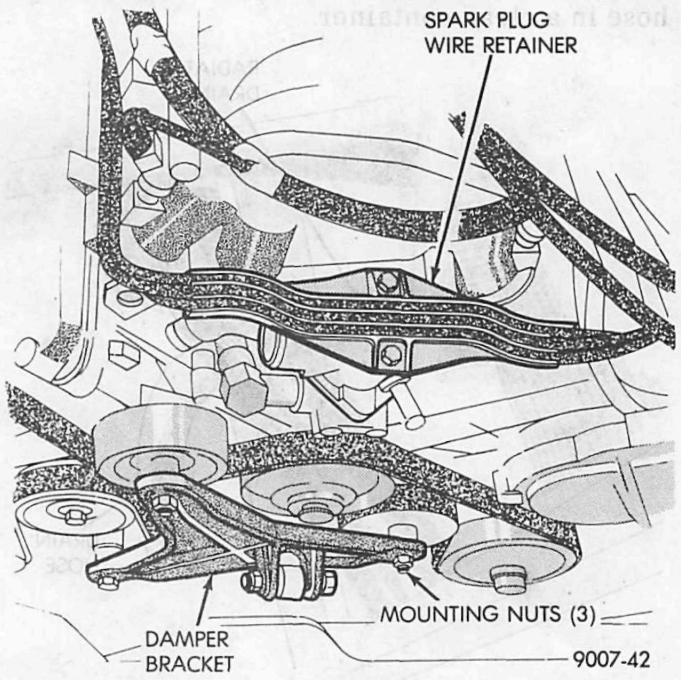


Fig. 4—Spark Plug Wire Retainer and Engine Front Damper Bracket

(9) Position accessory drive belt away from water pump.

(10) Remove radiator upper and lower hoses from water pump.

(11) Disconnect coolant temperature sensor wire connector from harness (Fig. 5).

(12) Loosen clamps securing cylinder head to water pump hoses at cylinder heads. Do not remove the hoses at this time.

(13) Loosen clamps securing heater hoses and Y-tube connecting hose at rear of water pump (Fig. 6).

(14) Lightly tap heater tube locking sleeve out of elbow connector of the water pump (Fig. 7).

(15) Remove the water pump upper mounting bolts (Fig. 8).

(16) Using an open end wrench, remove water pump lower mounting bolt (Fig. 8).

Grasp the bottom of water pump pulley, pull out and up to remove water pump.

If necessary, replace cylinder head hoses, coolant temperature sensor, thermostat and housing, and water pump pulley. If a new pump is installed, attach replacement hoses, thermostat and housing, coolant temperature sensor and water pump pulley to new water pump.

Installation

(1) Tilt top of water pump back and start pump to cylinder head hoses over hose necks on cylinder heads. Line up heater hose and Y-tube connecting hose with nipples at rear of water pump.

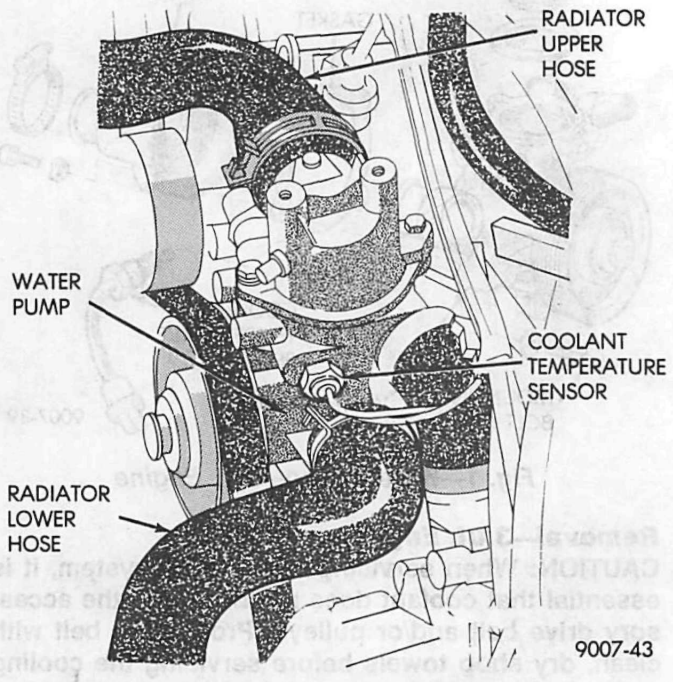


Fig. 5—Radiator Hoses and Coolant Temperature Sensor

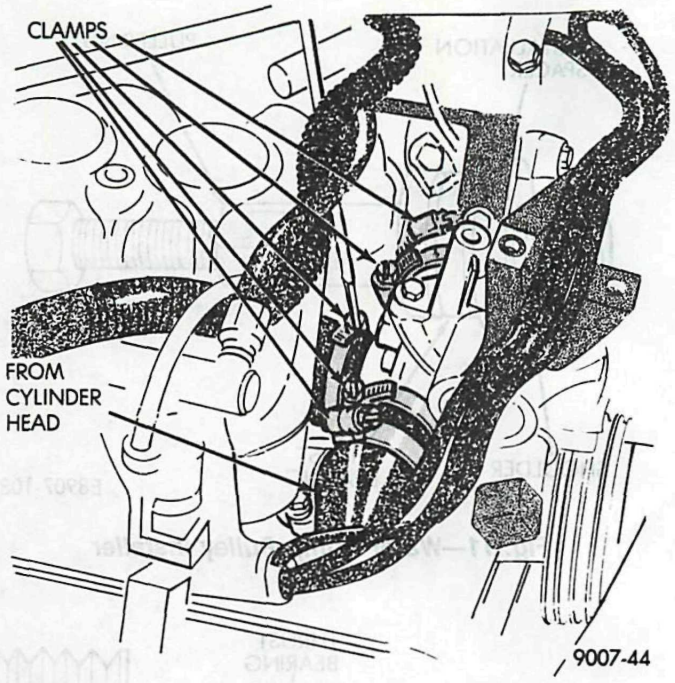


Fig. 6—Cylinder Head and Y-tube Hoses

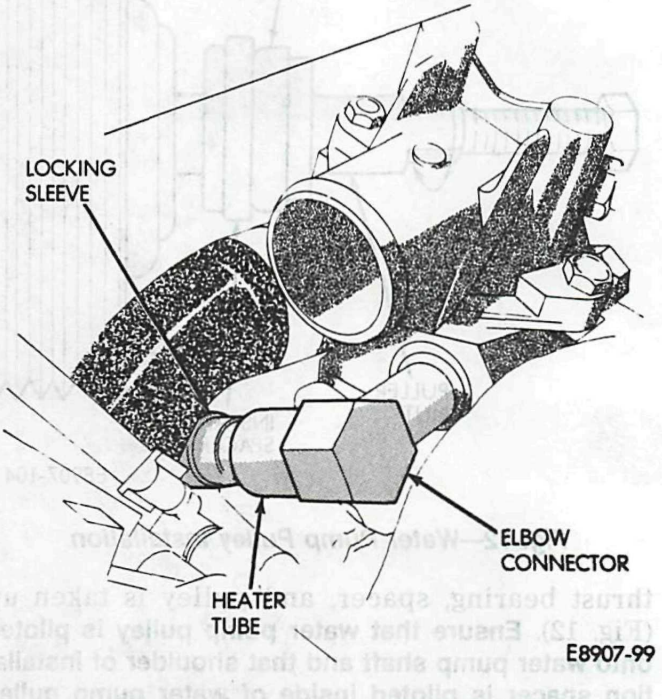


Fig. 7—Heater Tube Locking Sleeve

Align heater tube and lock ring with elbow connector.

(2) Push water pump down and back. Ensure that all hoses are correctly installed and not curled under.

(3) The heater tube elbow connector has O-rings inside that seal the heater tube. The tube must be pushed into the elbow until it stops to ensure complete engagement of the tube and O-rings.

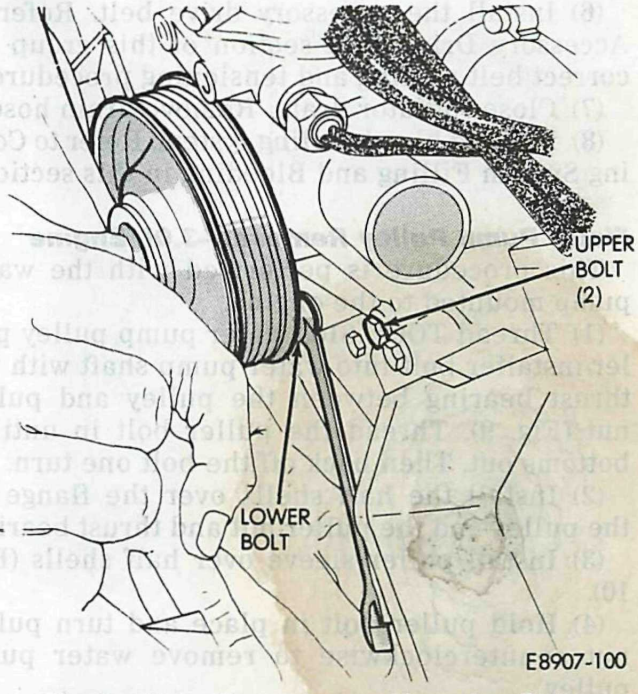


Fig. 8—Water Pump Lower Mounting Bolt Removal/Installation

With the tube completely installed into the elbow, push the lock ring up into the elbow as far as it will travel. The heater tube to elbow connection will leak if not properly connected.

(4) Tighten water pump mounting bolts to 17.5 N·m (13 ft-lbs) torque.

(5) Tighten all hose clamps.

CAUTION: When installing the accessory drive belt, the belt MUST be routed correctly. Incorrect belt routing can cause the water pump to rotate in the opposite direction resulting in engine overheating.

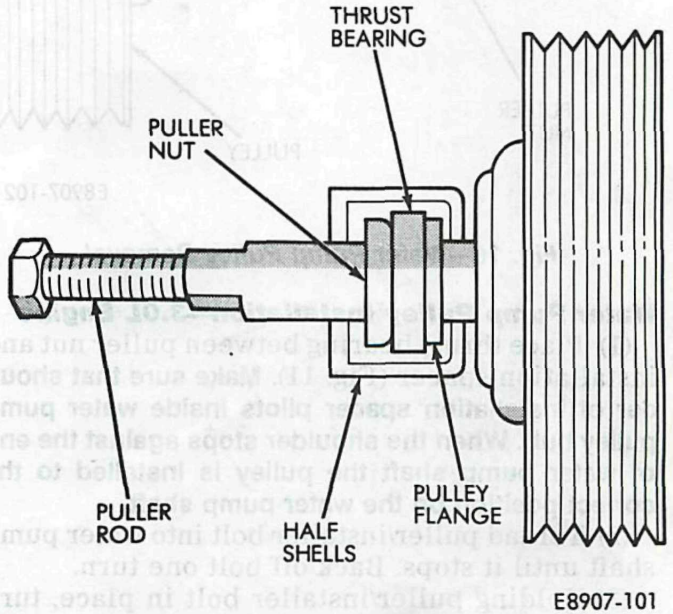


Fig. 9—Water Pump Puller Installation

(6) Install the accessory drive belt. Refer to Accessory Drive Belt section of this group for correct belt routing and tensioning procedures.
(7) Close radiator drain. Remove drain hose.
(8) Fill and bleed cooling system. Refer to Cooling System Filling and Bleeding in this section.

Water Pump Pulley Removal—3.0L Engine

This procedure is performed with the water pump mounted to the engine.
(1) Thread TOOL 6160 water pump pulley puller/installer bolt into water pump shaft with the thrust bearing between the pulley and puller nut (Fig. 9). Thread the puller bolt in until it bottoms out. Then back off the bolt one turn.
(2) Install the half shells over the flange on the pulley and the puller nut and thrust bearing.
(3) Install puller sleeve over half shells (Fig. 10).
(4) Hold puller bolt in place and turn puller nut counterclockwise to remove water pump pulley.

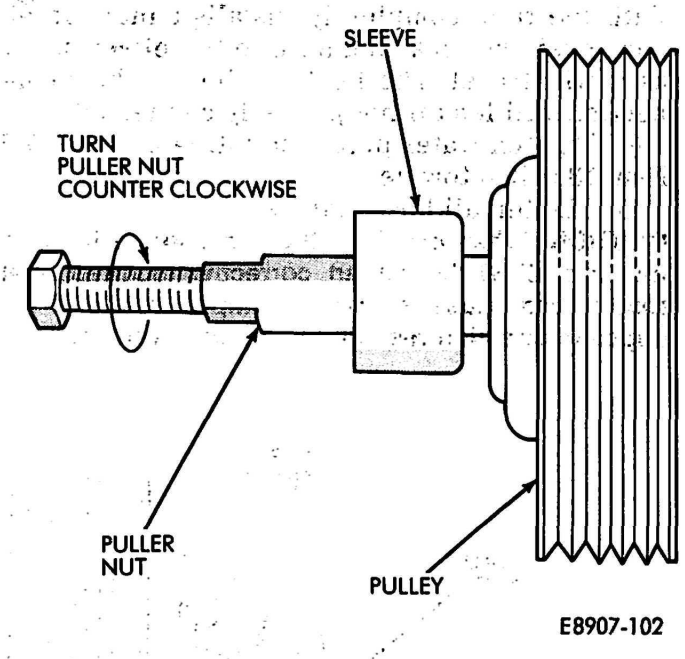


Fig. 10—Water Pump Pulley Removal

Water Pump Pulley Installation—3.0L Engine

(1) Place thrust bearing between puller nut and installation spacer (Fig. 11). **Make sure that shoulder of installation spacer pilots inside water pump pulley hub. When the shoulder stops against the end of water pump shaft the pulley is installed to the correct position on the water pump shaft.**
(2) Thread puller/installer bolt into water pump shaft until it stops. Back off bolt one turn.
(3) Holding puller/installer bolt in place, turn puller nut clockwise until slack between nut,

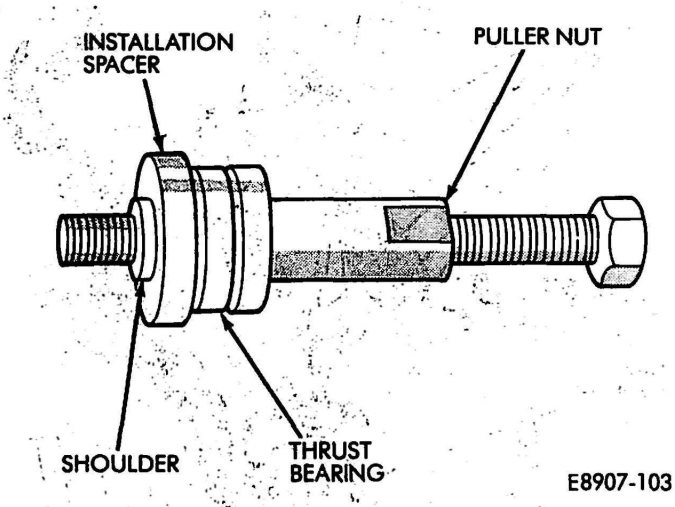


Fig. 11—Water Pump Pulley Installer

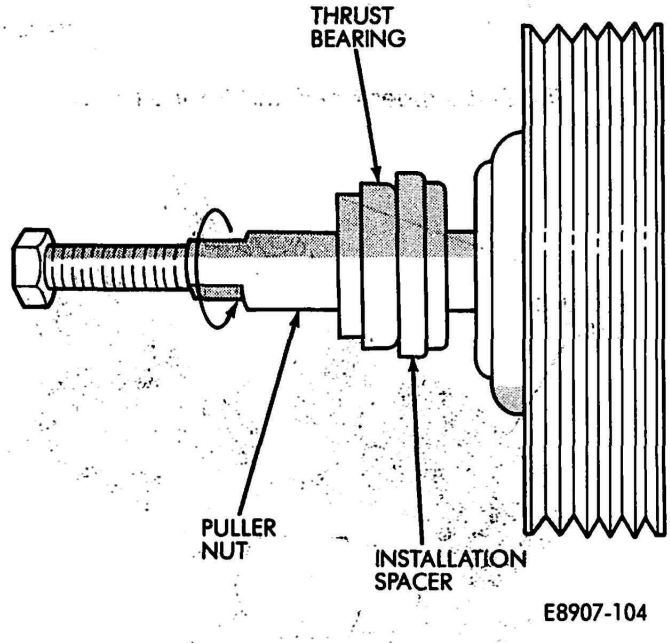


Fig. 12—Water Pump Pulley Installation

thrust bearing, spacer, and pulley is taken up (Fig. 12). **Ensure that water pump pulley is piloted onto water pump shaft and that shoulder of installation spacer is piloted inside of water pump pulley hub.**
(4) Turn puller nut in clockwise direction until it stops. Remove tool.

ENGINE THERMOSTAT

Description and Operation

A pellet-type thermostat controls the operating temperature of the engine by controlling the amount of coolant flow to the radiator. The thermostat used in 3.0L engines is closed below 88°C

(190°F). Above these temperatures, coolant is allowed to flow to the radiator. This provides quick engine warmup and overall temperature control. The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes longer engine warmup time, unreliable warmup performance, increased exhaust emissions, and crankcase condensation that can result in sludge formation.

CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.

On 3.0L engines, the words **TO RAD** are stamped onto the top of the thermostat for installation reference. Both thermostats are equipped with an air bleed valve. The thermostat is installed with the air bleed valve positioned in a certain position. Refer to Thermostat Installation in this section.

Thermostat Removal—3.0L Engine

When servicing the thermostat, do not allow coolant to drip onto the accessory drive belt and/or accessory drive pulleys. If coolant does contact the drive belt or pulleys, flush them with clean water.

The thermostat is located at the front of the engine behind the accessory drive belt (Fig. 13).

WARNING: DO NOT LOOSEN THE RADIATOR DRAIN WITH THE SYSTEM HOT AND PRESSURIZED BECAUSE SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

Do not waste reusable coolant. If the solution is clean and being drained only to service the cooling system, drain the coolant into a clean container for reuse.

(1) Drain the coolant from the radiator until the level is below the thermostat housing.

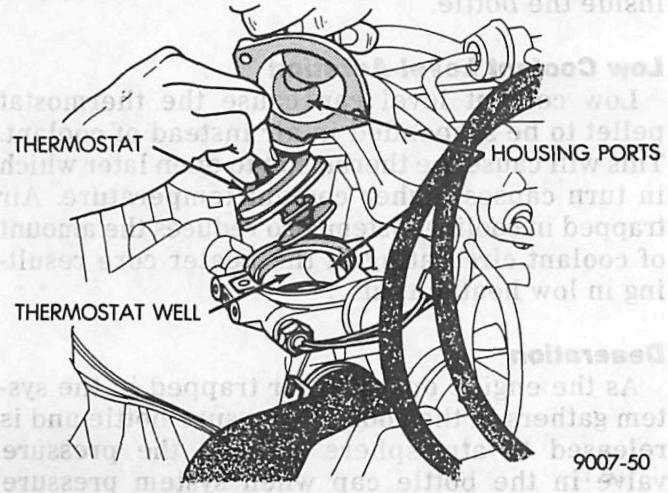


Fig. 13—Thermostat Housing 3.0L

(2) Disconnect the coolant temperature sensor wire connector from the sensor.

(3) Remove the spark plug wire holder from the top of the thermostat housing. Place shop towels on belts and pulleys.

(4) Remove thermostat housing (Leave upper radiator hose connected.)

(5) Remove thermostat.

(6) Check thermostat well and housing ports for blockage. Repair as necessary. (Fig. 13)

(7) Clean gasket surfaces.

Thermostat Testing

Remove the thermostat. Refer to Thermostat Removal. Insert a 0.076mm (0.003-in) feeler gauge, with a wire or string attached, between the thermostat valve and seat (Fig. 14).

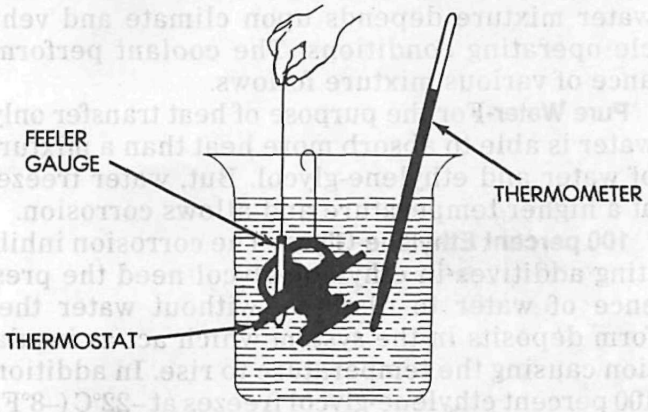
WARNING: ANTIFREEZE IS POISONOUS. KEEP OUT OF THE REACH OF CHILDREN.

Submerge the thermostat in a container containing a 50/50 water/antifreeze mixture and suspend it so that it does not touch the sides or the bottom of the container (Fig. 14).

Suspend a thermometer in the antifreeze so that it does not contact the container or thermostat.

WARNING: DO NOT BREATHE THE VAPOR. ENSURE THAT THE TEST AREA IS PROPERLY VENTILATED.

Heat the antifreeze. Apply a slight tension on the feeler gauge while the antifreeze is heated. When the valve opens the feeler gauge will slip free from the valve. Note the temperature and refer to specifications chart (Fig. 14). The opening and fully open temperatures listed in the



Must Be Open 0.076mm (0.003 inch)	3.0L-88°C (190°F)
Must Be Fully Open	3.0L-101°C (214°F)

9007-51

Fig. 14—Thermostat Calibrations

specifications chart are nominal specifications. If defective, replace the thermostat.

Install the thermostat. Refer to Thermostat Installation.

Installation

The thermostat has an air bleed valve. When installing the thermostat, position the valve to the back of the thermostat well. This is the highest point of the well which is where air will settle in.

(1) Install the thermostat with the air bleed valve to the rear of the thermostat well and the flat disk to the bottom of the thermostat well.

(2) Install the thermostat housing. Tighten the mounting bolts to 12 N·m (9 ft-lbs). (Fig. 13)

(3) Close radiator drain and remove hose.

(4) Fill and bleed the cooling system (see Engine Cooling System Section—Filling and Bleeding Procedures).

COOLANT

Coolant flows through the engine and absorbs heat produced during engine operation. The coolant carries the heat to the radiator and heater core where it is transferred to the ambient air passing through the radiator and heater core fins. The coolant also removes heat from the automatic transmission fluid at the transmission oil cooler.

Coolant Performance

The required ethylene-glycol (anti-freeze) and water mixture depends upon climate and vehicle operating conditions. The coolant performance of various mixture follows.

Pure Water-For the purpose of heat transfer only, water is able to absorb more heat than a mixture of water and ethylene-glycol. But, water freezes at a higher temperature and allows corrosion.

100 percent Ethylene-Glycol-The corrosion inhibiting additives in ethylene-glycol need the presence of water to dissolve, without water they form deposits in the system which act as insulation causing the temperature to rise. In addition, 100 percent ethylene-glycol freezes at –22°C (–8°F).

50/50 Ethylene-Glycol and Water-A 50/50 mixture by volume is recommended as it provides protection against freezing to –37°C (–35°F). The antifreeze concentration **MUST ALWAYS** be a minimum of 44 percent, year-round in all climates. If the percentage is lower, engine parts may be eroded by cavitation. Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to –67.7°C (–90°F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

CAUTION: Richer mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

Coolant Selection-Additives

Maintain the coolant at the specified level with a mixture of ethylene glycol-based antifreeze (containing ALUGARD 340-2™) and low mineral content water.

CAUTION: Do not use coolant additives that are claimed to improve engine cooling.

Coolant Service

It is recommended that the cooling system be drained and flushed at 48,000 kilometers (30,000 miles) or 30 months, which ever comes first and, thereafter, at the start of every winter season.

Coolant Level Check

Check the coolant level at the coolant pressure bottle with engine cold. To check coolant level, slowly remove the coolant pressure bottle cap (engine must be cold) and look down into the bottle. The coolant level is correct when it is at the top of the post inside the coolant pressure bottle.

Adding Additional Coolant-Routine

WARNING: DO NOT REMOVE COOLANT PRESSURE BOTTLE CAP WHEN THE ENGINE IS HOT. SERIOUS PERSONAL INJURY CAN RESULT FROM HOT COOLANT.

Only add coolant when the engine is *cold*. Remove the coolant pressure bottle cap and add coolant until the level is at the top of the post inside the bottle.

Low Coolant Level-Aeration

Low coolant level can cause the thermostat pellet to be suspended in air instead of coolant. This will cause the thermostat to open later which in turn causes higher coolant temperature. Air trapped in cooling system also reduces the amount of coolant circulating in the heater core resulting in low heat output.

Deaeration

As the engine operates air trapped in the system gathers in the coolant pressure bottle and is released to atmosphere through the pressure valve in the bottle cap when system pressure reaches 110-124 kPa (16-18 psi). The air is replaced with coolant from the coolant pressure

bottle. The radiator does not have a pressure cap. The cap on the coolant pressure bottle is the only cap used in the system.

COOLING SYSTEM DRAIN, CLEAN FLUSH AND REFILL

Draining Cooling System

When servicing the cooling system, it is essential that coolant does not drip onto the accessory drive belt and/or pulleys. Protect the belt with shop towels before working on the cooling system. If coolant contacts the belt or pulley, flush them with clean water.

(1) Attach one end of a 6.35 mm (1/4 in) ID hose, that is approximately 914 mm (36 in) long, to radiator drain. Place the other end of the hose in a clean container with a capacity of at least three gallons (Fig. 15).

(2) Open radiator drain.

(3) Remove coolant pressure bottle cap and let radiator drain (Fig. 16).

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR COOLANT PRESSURE BOTTLE CAP, OR LOOSEN THE RADIATOR DRAINCOCK, WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

(4) ONCE THE ENGINE HAS COOLED DOWN, remove the cylinder block drain plug(s). On 3.0L engines, remove the drain plug located behind and below each exhaust manifold (Fig. 17 and Fig. 18).

(5) Drain engine.

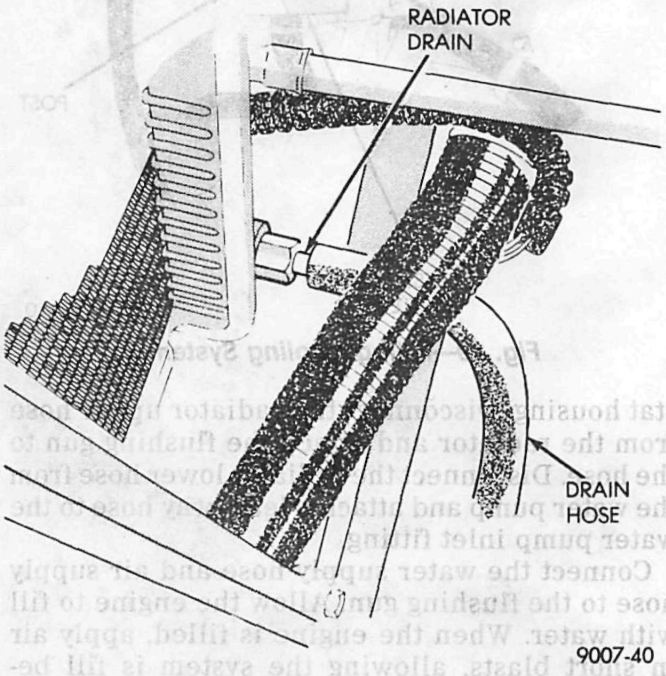


Fig. 15—Radiator Drain and Drain Hose

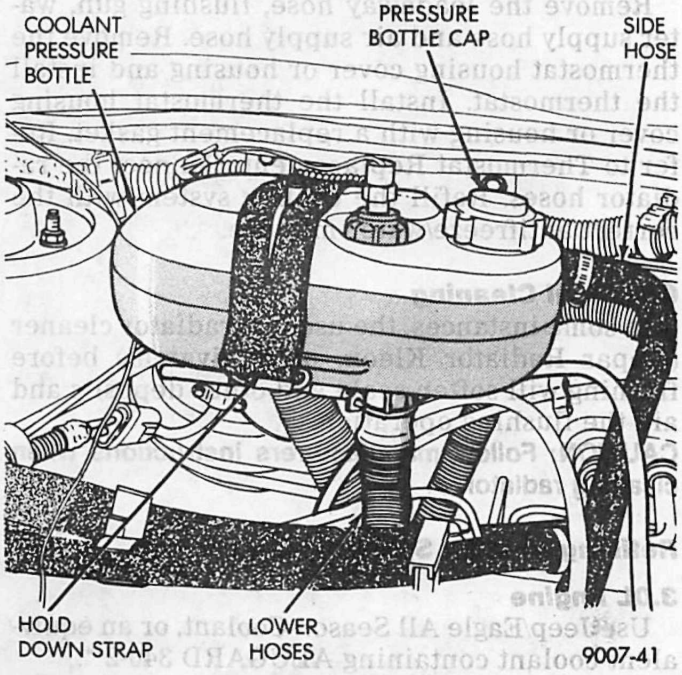


Fig. 16—Coolant Pressure Bottle Cap

Cooling System Cleaning, Reverse Flushing

CAUTION: The cooling system normally operates at 108-140 kPa (16-20 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

Cleaning

Drain cooling system and refill with water. Refer to Filling and Bleeding sections of this group. Run engine with pressure bottle cap installed

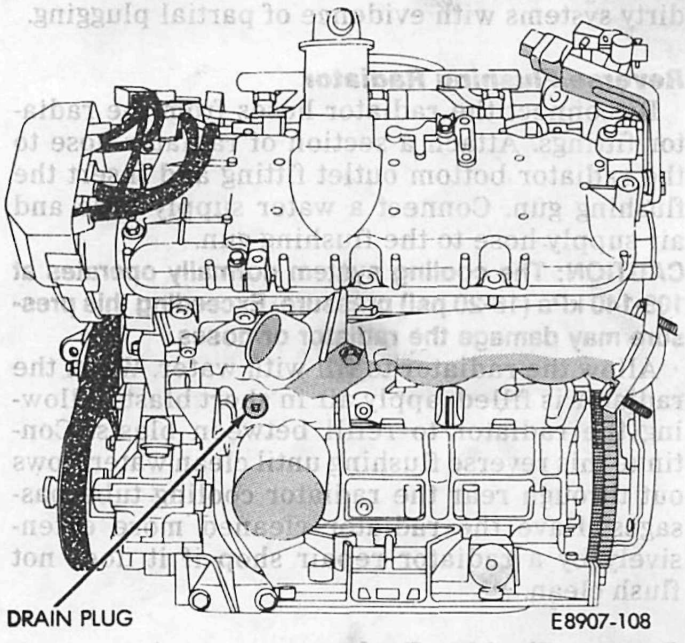


Fig. 17—3.0L Engine Cylinder Block Drain Plug—Left Side

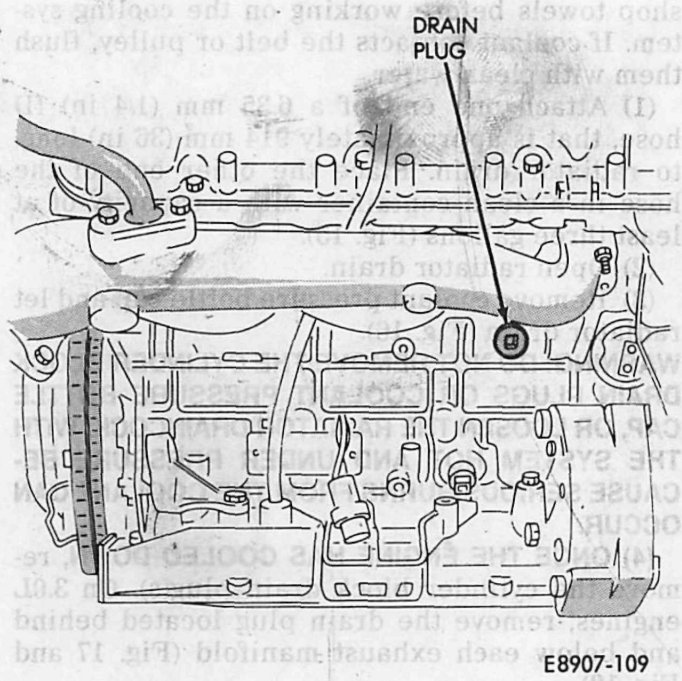


Fig. 18—3.0L Engine Cylinder BLock Drain Plug—Right Side

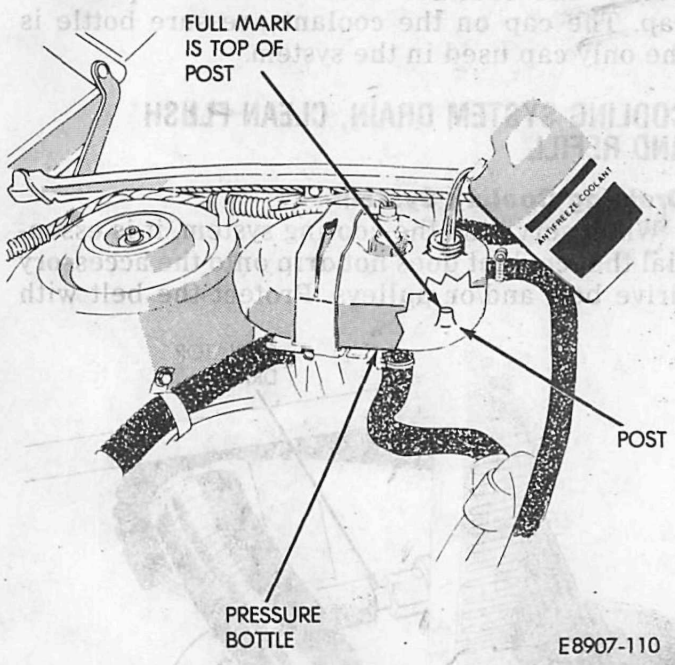


Fig. 19—Filling Cooling System

until radiator upper hose is hot. Stop engine and drain water from system. If water is dirty, fill system with water, run engine, and drain system. Repeat until water drains clean.

Reverse Flushing

Reverse flushing of the cooling system is forcing of water through the cooling system, using air pressure, in the opposite direction of normal coolant flow. This is usually only necessary with very dirty systems with evidence of partial plugging.

Reverse Flushing Radiator

Disconnect the radiator hoses from the radiator fittings. Attach a section of radiator hose to the radiator bottom outlet fitting and insert the flushing gun. Connect a water supply hose and air supply hose to the flushing gun.

CAUTION: The cooling system normally operates at 108-140 kPa (16-20 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

Allow the radiator to fill with water. When the radiator is filled, apply air in short blasts, allowing the radiator to refill between blasts. Continue this reverse flushing until clean water flows out through rear the radiator cooling tube passages. Have the radiator cleaned more extensively by a radiator repair shop if it does not flush clean.

Reverse Flushing Engine

Drain the cooling system. Remove the thermostat housing and thermostat. Install the thermostat housing. Disconnect the radiator upper hose from the radiator and attach the flushing gun to the hose. Disconnect the radiator lower hose from the water pump and attach a leadaway hose to the water pump inlet fitting.

Connect the water supply hose and air supply hose to the flushing gun. Allow the engine to fill with water. When the engine is filled, apply air in short blasts, allowing the system is fill between air blasts. Continue until clean water flows through the leadaway hose.

Remove the leadaway hose, flushing gun, water supply hose and air supply hose. Remove the thermostat housing cover or housing and install the thermostat. Install the thermostat housing cover or housing with a replacement gasket. Refer to Thermostat Replacement. Connect the radiator hoses. Refill the cooling system with the correct antifreeze/water mixture.

Chemical Cleaning

In some instances, the use of a radiator cleaner (Mopar Radiator Kleen, or equivalent) before flushing will soften scale and other deposits and aid the flushing operation.

CAUTION: Follow manufacturers instructions when cleaning radiator.

Refilling Cooling System

3.0L Engine

Use Jeep/Eagle All Season Coolant, or an equivalent coolant containing ALUGARD 340-2™.

(1) Close radiator drain.

(2) Remove drain hose.

CAUTION: The gaskets (copper colored washer) on the V-6 cylinder block drain plugs MUST be replaced each time the drain plugs are removed.

(3) Install the cylinder block drain plugs with new gaskets.

WARNING: WHEN INSTALLING DRAIN HOSE TO AIR BLEED VALVE ON THERMOSTAT HOUSING, ROUTE HOSE AWAY FROM ACCESSORY DRIVE BELT, ACCESSORY DRIVE PULLEYS, AND ELECTRIC COOLING FAN.

(4) Attach one end of a 6.35 mm (.250 in) ID hose that is approximately 1219 mm (48 in) long, to the bleed valve on the thermostat housing (Fig. 20). Route the hose away from the accessory drive belt, drive pulleys and electric cooling fan. Place the other end of hose into a clean container. The hose will prevent coolant from contacting the accessory drive belt when bleeding the system during the refilling operation.

(5) Open bleed valve.

(6) Slowly fill coolant pressure bottle (Fig. 19) until a steady stream of coolant flows from hose attached to the bleed valve.

(7) Close bleed valve and continue filling to the full mark of the coolant pressure bottle. The full mark is the top of the post inside the bottle (Fig. 19).

(8) Install cap tightly on coolant pressure bottle.

(9) Remove hose from bleed valve.

(10) Start and run engine until the upper radiator hose is warm to the touch.

(11) Turn engine off.

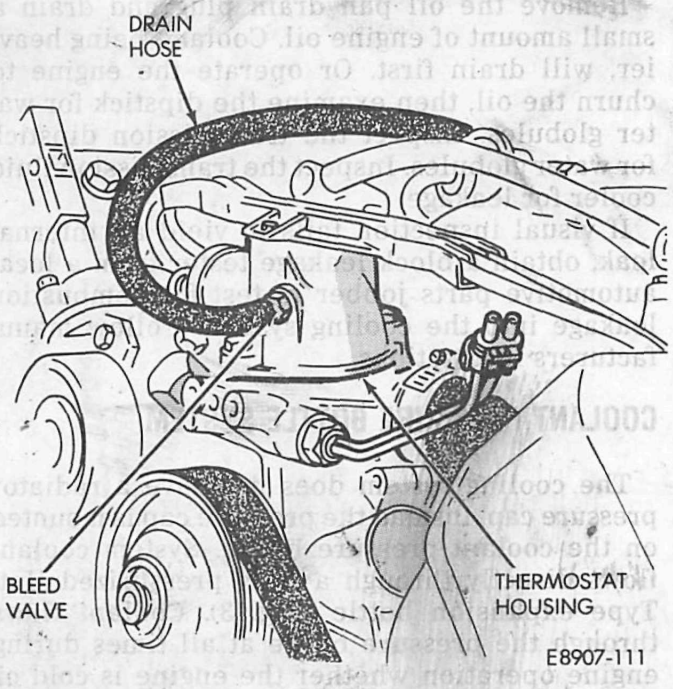


Fig. 20—Air Bleed Valve on Thermostat Housing

(12) Reattach drain hose to bleed valve on thermostat housing. **Route hose away from the accessory drive belt, accessory drive pulleys, and electric cooling fan.**

(13) Open bleed valve until a steady stream of coolant flows from the hose.

(14) Close bleed valve and remove hose.

(15) Ensure that coolant level in coolant pressure bottle is at or slightly above the full mark (at the top of the post inside the coolant pressure bottle). **The full mark on the coolant pressure bottle is the correct coolant level for a cold engine. A hot engine will normally have a coolant level higher than the full mark.**

Cooling System Bleeding Procedure—With 3.0L Engine

This procedure should be followed after any cooling system component has been replaced or removed and installed.

It is essential that coolant does not contact the accessory drive belt or pulleys. If coolant contacts the accessory drive belt or drive pulleys, flush them with clean water.

WARNING: WHEN INSTALLING DRAIN HOSE TO AIR BLEED VALVE ON THERMOSTAT HOUSING, ROUTE HOSE AWAY FROM ACCESSORY DRIVE BELT, ACCESSORY DRIVE PULLEYS, AND ELECTRIC COOLING FAN.

(1) Attach one end of a 6.35 mm (.250 in) ID hose that is approximately 1219 mm (48 in) long, to the bleed valve on the thermostat housing (Fig. 20). Route the hose away from the accessory drive belt and pulleys. Place the other end of the hose into a clean container. The hose will prevent coolant from contacting the accessory drive belt and drive pulleys.

(2) Open bleed valve.

(3) Slowly fill coolant pressure bottle until a steady stream of coolant flows from hose attached to the bleed valve.

(4) Close bleed valve and continue filling to the full mark of the coolant pressure bottle. The full mark is the top of the post inside the bottle.

(5) Install cap tightly on coolant pressure bottle.

(6) Remove hose from bleed valve.

(7) Start and run engine until the upper radiator hose is warm to the touch.

(8) Turn engine off.

(9) Reattach drain hose to bleed valve on thermostat housing. **Route hose away from the accessory drive belt, accessory drive pulleys, and electric cooling fan.**

(10) Open bleed valve until a steady stream of coolant flows from the hose.

(11) Close bleed valve and remove hose.

(12) Ensure that coolant pressure bottle is at or slightly above the full mark (at the top of the post inside the coolant pressure bottle). **The full mark on the coolant pressure bottle is the correct coolant level for a cold engine. A hot engine will normally have a coolant level higher than the full mark.**

TESTING COOLING SYSTEM FOR LEAKS

Ultraviolet Light Method

All vehicles have a leak detection additive added to the cooling system before they leave the factory. The additive is highly visible under ultraviolet light (black light). If the factory original coolant has been drained, pore one ounce of additive into the cooling system. The additive is available through the parts department. Start and operate the engine until the radiator upper hose is warm to the touch. Aim the black light at the components to be checked. If leaks are present, the black light will cause the additive to glow a bright green color (Fig. 1).

The black light can be used in conjunction with a pressure tester to determine if any external leaks exist.

Pressure Tester Method

(1) Remove cap from pressure bottle and install pressure tester adapter in place.

(2) Connect pressure tester to adapter (Fig. 2).

(3) Start and operate engine until radiator upper hose is warm.

(4) Stop engine.

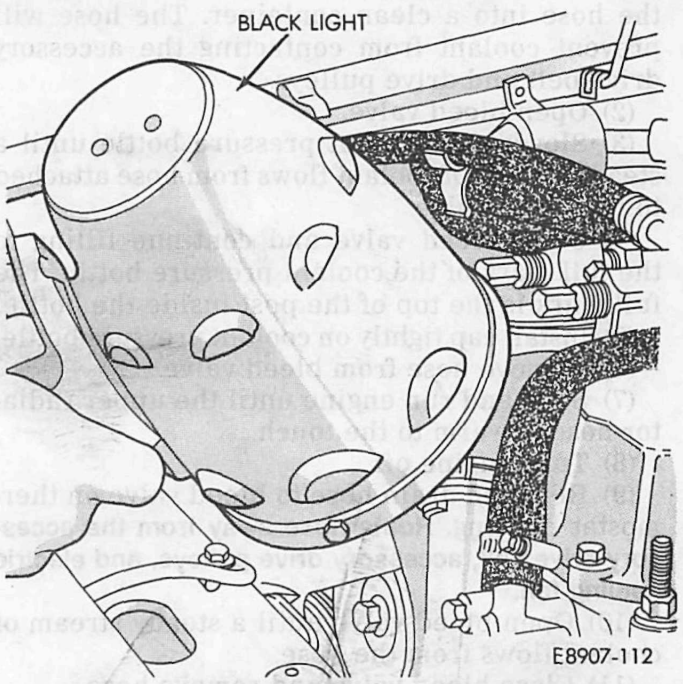


Fig. 1—Leak Detection Using Ultraviolet Light

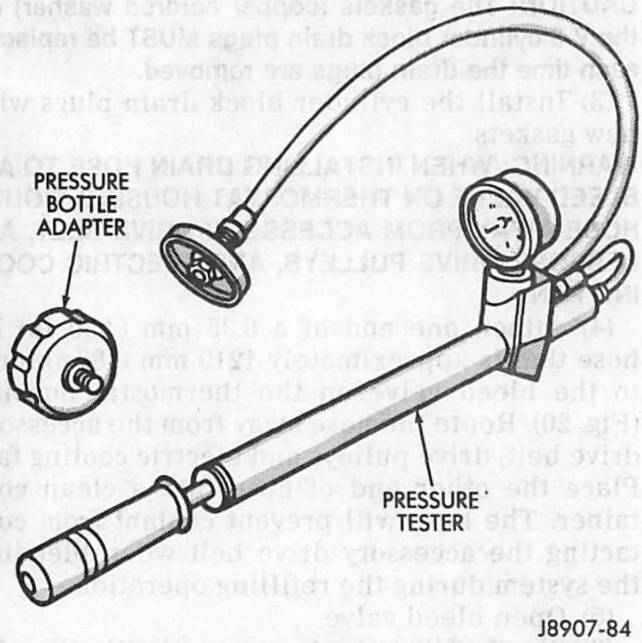


Fig. 2—Pressure Bottle System Pressure Tester

(5) Pump tool pressure tester until pressure reading on tool gauge is 108-140 kPa (16-20 psi). Pressure should remain steady. If a pressure drop occurs, inspect cooling system for leaks.

Correct any leaks and test system again. Disconnect tester tools from pressure bottle and test pressure cap. Refer to pressure cap testing.

Internal Leakage Inspection

Remove the oil pan drain plug and drain a small amount of engine oil. Coolant, being heavier, will drain first. Or operate the engine to churn the oil, then examine the dipstick for water globules. Inspect the transmission dipstick for water globules. Inspect the transmission fluid cooler for leakage.

If visual inspection fails to yield an internal leak, obtain a block leakage tester from a local automotive parts jobber to test for combustion leakage into the cooling system. Follow manufacturers instructions.

COOLANT PRESSURE BOTTLE SYSTEM

The cooling system does not have a radiator pressure cap. Instead the pressure cap is mounted on the coolant pressure bottle. System coolant flows directly through a fully pressurized Hot-Type expansion bottle (Fig. 3). Coolant flows through the pressure bottle at all times during engine operation whether the engine is cold or at normal operating temperatures.

Larger coolant volume caused by thermal expansion during engine operation is absorbed by the expansion chamber in the bottle. Air trapped in the system is purged through the pressure cap vent valve during maximum coolant expansion.

The cooling system remains pressurized when the coolant contracts during engine cool-down. Coolant volume in the pressure bottle returns to the normal cold engine level during this period.

Removal

WARNING: DO NOT REMOVE COOLANT PRESSURE BOTTLE CAP WHEN THE ENGINE IS HOT. SERIOUS PERSONAL INJURY CAN RESULT FROM HOT COOLANT. ALLOW ENGINE TO COOL BEFORE REMOVING COOLANT PRESSURE BOTTLE CAP.

The coolant pressure bottle, located on the passenger side of the dash panel, has two dowels at the rear that fit into slots in the mounting bracket. A rubber hold down strap holds the pressure bottle in place.

(1) Install hose collapsing clamps on coolant bottle lower hose and side hose.

(2) Position a clean container under the coolant bottle. Remove lower hose and catch coolant in container.

(3) Remove hose from side of coolant bottle (Fig. 3).

(4) Remove hold down strap (Fig. 3).

(5) Remove coolant bottle (Fig. 3).

Installation

(1) Install coolant pressure bottle.

(2) Lock hold down strap in place (Fig. 3).

(3) Install lower hose to coolant bottle (Fig. 3).

(4) Install hose to side of coolant bottle (Fig. 3).

(5) Remove hose collapsing clamps.

(6) Refill pressure bottle with coolant to top of post inside bottle.

PRESSURE BOTTLE CAP

The pressure bottle is equipped with a pressure cap which releases pressure at some point within a range of 110-124 kPa (16-18 psi).

The cooling system will operate at pressures slightly above atmospheric pressure. This results in a higher coolant boiling point allowing increased radiator cooling capacity. The cap contains a spring-loaded pressure relief valve that opens when system pressure reaches the release range of 110-124 kPa (16-18 psi).

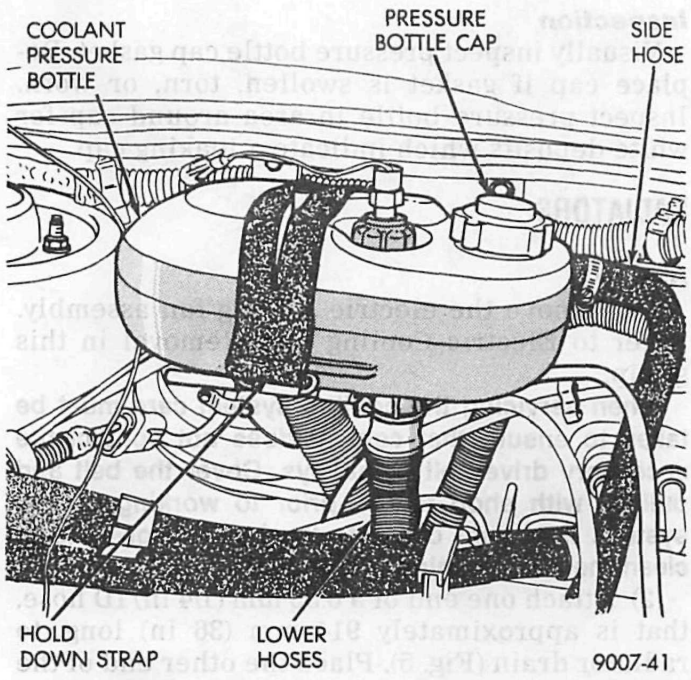


Fig. 3—Coolant Pressure Bottle Removal/Installation

PRESSURE TESTING COOLANT PRESSURE BOTTLE CAP

(1) Install cap adapter on pressure tester (Fig. 4).

(2) Connect pressure bottle cap to adapter and pressurize cap to 124 kPa (18 psi).

(3) Cap pressure should stabilize within ± 6.9 kPa (1 psi) of this setting.

(4) Replace cap if pressure does not stabilize within specified limits.

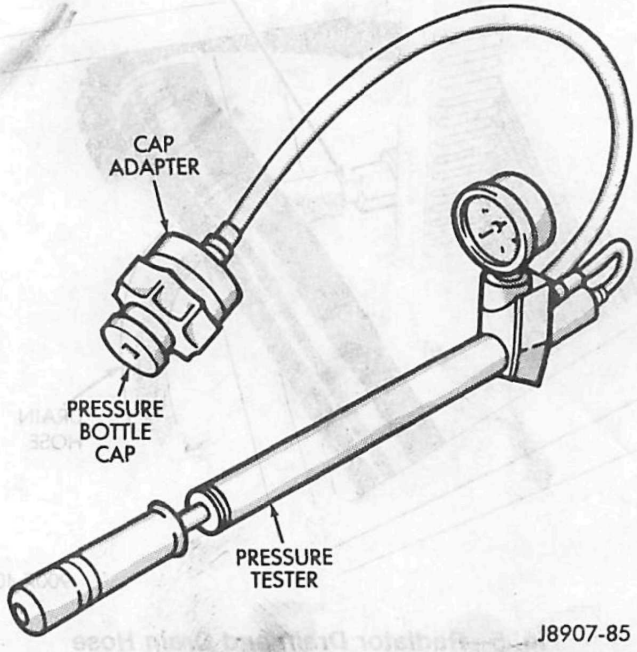


Fig. 4—Pressure Testing Pressure Bottle Cap

Inspection

Visually inspect pressure bottle cap gasket. Replace cap if gasket is swollen, torn, or worn. Inspect pressure bottle in area around cap for white deposits which indicate a leaking cap.

RADIATORS

Removal

(1) Remove the electric cooling fan assembly. Refer to Electric Cooling Fan Removal in this group.

When servicing the cooling system care must be taken to ensure that coolant does not contact the accessory drive belt or pulleys. Cover the belt and pulleys with shop towels prior to working on the system. If coolant contacts the belt and/or pulleys, clean them by flushing with water.

(2) Attach one end of a 6.35 mm (1/4 in) ID hose, that is approximately 914 mm (36 in) long, to radiator drain (Fig. 5). Place the other end of the hose in a clean container.

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR COOLANT PRESSURE BOTTLE CAP, OR LOOSEN THE RADIATOR DRAINCOCK, WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

(3) Open radiator drain.

(4) Remove coolant pressure bottle cap and let radiator drain (Fig. 6).

(5) Disconnect radiator upper and lower hoses from radiator.

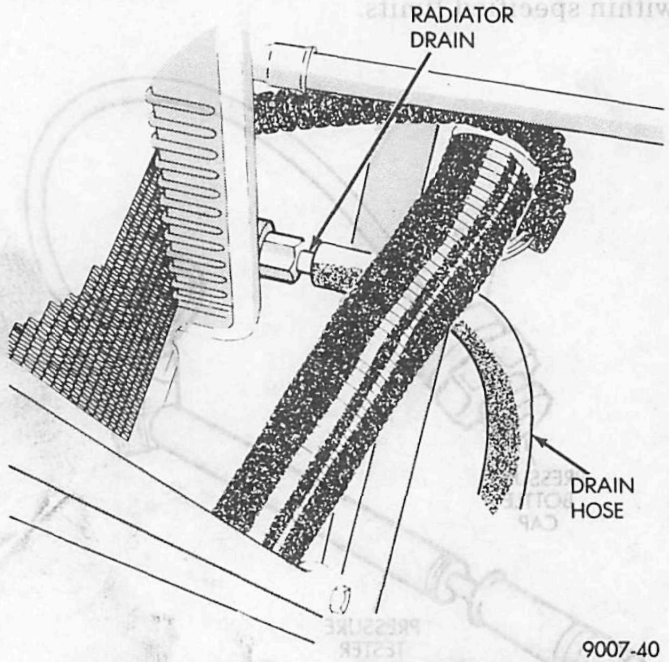


Fig. 5—Radiator Drain and Drain Hose

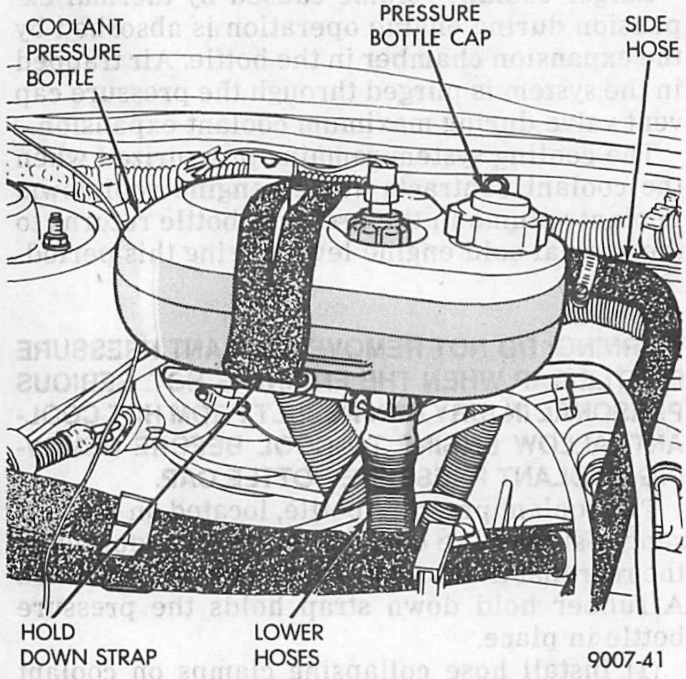


Fig. 6—Coolant Pressure Bottle Cap

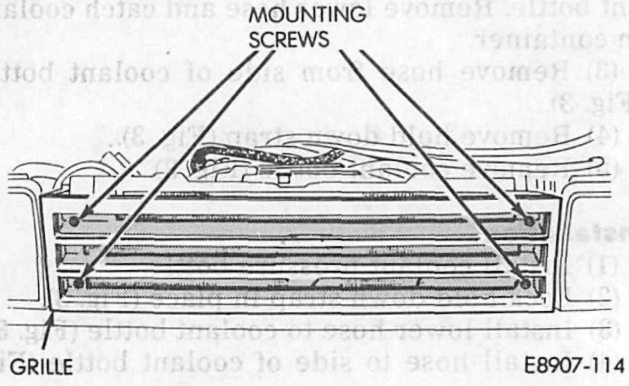


Fig. 7—Grille Removal/Installation

(6) Remove front grille mounting screws (Fig. 7). Remove grille.

(7) Disconnect the radiator from the air conditioning condenser by removing the top and bottom attaching screws (Fig. 8 and 9).

(8) Lift radiator out of vehicle.

Installation

The radiator is equipped with alignment dowels on the bottom that fit into holes in the body crossmember.

(1) Lower radiator into vehicle and align dowels with holes in crossmember (Fig. 10).

(2) Connect the radiator to the air conditioning condenser assembly (Fig. 8 and Fig. 9). Tighten attaching screws to 4 N·m (35 in-lbs) torque.

(3) Install grille (Fig. 7). Tighten grille mounting screws.

(4) Connect radiator upper and lower hoses to radiator.

(5) Close radiator drain. Remove hose used for draining.

(6) Install electric cooling fan. Refer to Electric Cooling Fan Installation in this group.

(7) Fill the cooling system (see Engine Cooling System Section—Filling and Bleeding Procedure).

Radiator Draincock Service

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUG(S) OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) Drain radiator. Refer to Cooling System Draining.

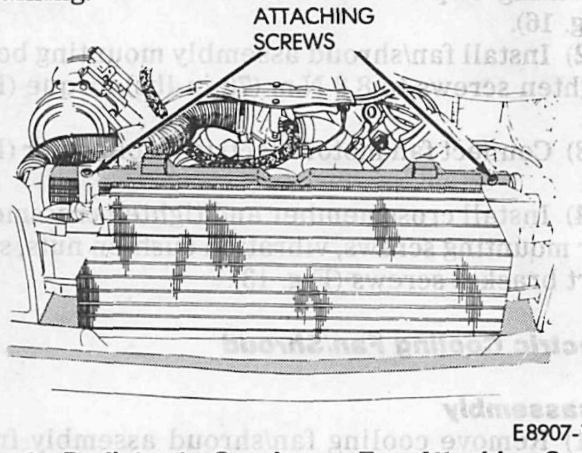


Fig. 8—Radiator to Condenser Top Attaching Screws

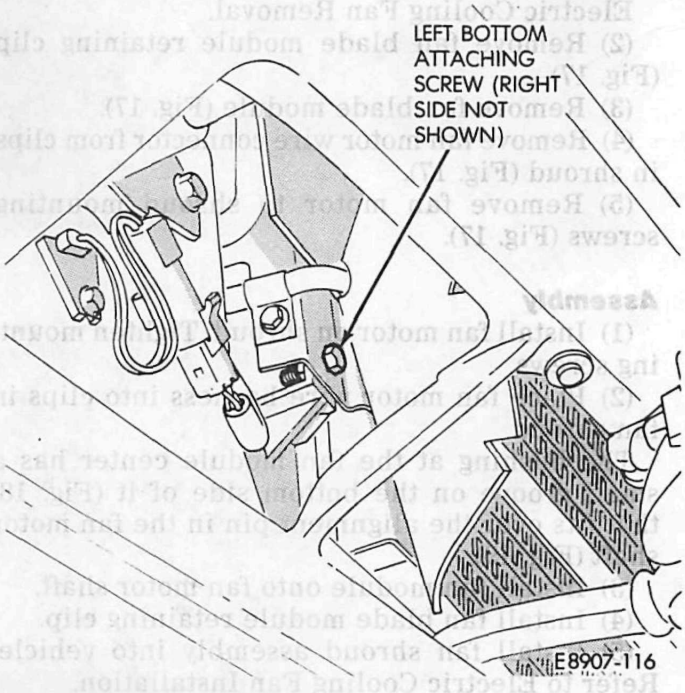


Fig. 9—Radiator to Condenser Bottom Attaching Screws

The Radiator is equipped with a plastic draincock with an integral O-ring seal. Two arms retain the draincock in the radiator once it has been completely unscrewed (Fig. 11).

(2) Pull draincock out of radiator tank after radiator has drained.

(3) Push the replacement draincock into the radiator tank and tighten.

(4) Fill radiator and bleed system. Refer to Filling and Bleeding Cooling System.

COOLING SYSTEM HOSES AND CLAMPS

Hoses

Rubber hoses route coolant to and from the radiator, automatic transmission oil cooler, pressure bottle and heater core.

Inspect the hoses at regular intervals. Replace hoses that are cracked, feel brittle when squeezed or swell excessively when the system is pressurized.

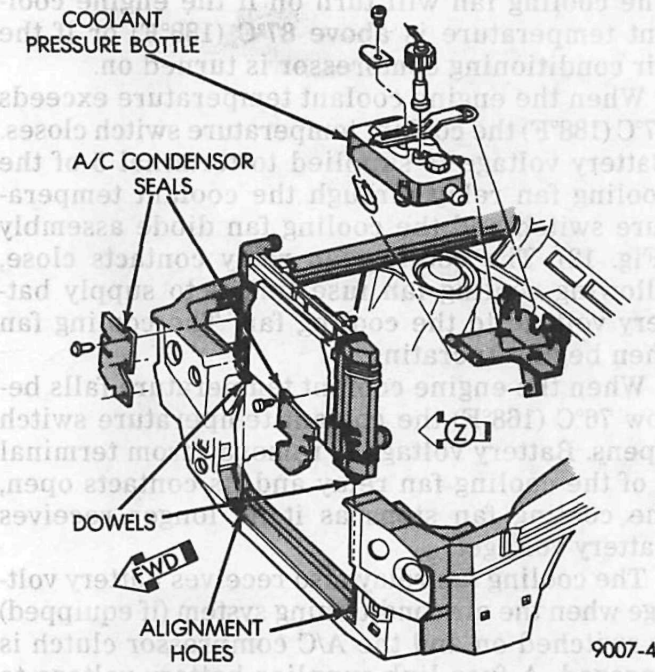


Fig. 10—Radiator Installation

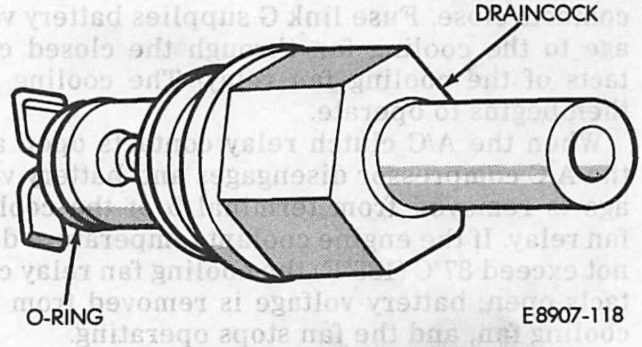


Fig. 11—Draincock Service

In areas where specific routing clamps are not provided, ensure that the hoses are positioned with sufficient clearance from the exhaust manifold and pipe, fan blades, drive belts and sway bars. Otherwise, improperly positioned hoses will be damaged, resulting in coolant loss and overheating.

Clamps

Constant tension hose clamps are used on many of the cooling system hoses. The clamp size is identified by a letter stamped on the tongue. Special pliers for removing and installing the clamps are available from most automotive jobbers.

ELECTRIC COOLING FAN

Operation

The cooling fan is turned on when the contacts of the cooling fan relay close and supply battery voltage to the motor from a fuse link G (Fig. 12). The cooling fan will turn on if the engine coolant temperature is above 87°C (188°F) or if the air conditioning compressor is turned on.

When the engine coolant temperature exceeds 87°C (188°F) the coolant temperature switch closes. Battery voltage is supplied to terminal 5 of the cooling fan relay through the coolant temperature switch and the cooling fan diode assembly (Fig. 12). The cooling fan relay contacts close, allowing cooling fan fuse link G to supply battery voltage to the cooling fan. The cooling fan then begins operating.

When the engine coolant temperature falls below 76°C (168°F) the coolant temperature switch opens. Battery voltage is removed from terminal 5 of the cooling fan relay and its contacts open, the cooling fan stops as it no longer receives battery voltage.

The cooling fan relay also receives battery voltage when the air conditioning system (if equipped) is switched on and the A/C compressor clutch is engaged. A fuse link supplies battery voltage to terminal 5 of the cooling fan relay and the cooling fan diode assembly. The cooling fan relay contacts close. Fuse link G supplies battery voltage to the cooling fan through the closed contacts of the cooling fan relay. The cooling fan then begins to operate.

When the A/C clutch relay contacts open and the A/C compressor disengages and battery voltage is removed from terminal 5 of the cooling fan relay. If the engine coolant temperature does not exceed 87°C (188°F) the cooling fan relay contacts open, battery voltage is removed from the cooling fan, and the fan stops operating.

Removal

(1) Disconnect negative cable from battery.

(2) Remove support bracket screws, vibration cushion nuts, and radiator upper crossmember mounting screws (Fig. 13).

(3) Remove crossmember (Fig. 13).

(4) Disconnect fan motor wire connector (Fig. 14).

(5) Remove cooling fan/shroud assembly mounting screws (Fig. 15).

(6) Remove fan/shroud assembly by lifting upwards.

Installation

(1) Lower fan/shroud assembly into place, ensure that tabs at bottom of fan shroud fit into retaining clips in lower radiator crossmember (Fig. 16).

(2) Install fan/shroud assembly mounting bolts. Tighten screws to 8.8 N·m (78 in-lbs) torque (Fig. 15).

(3) Connect fan motor electrical connector (Fig. 14).

(4) Install crossmember and tighten crossmember mounting screws, vibration cushion nuts, support bracket screws (Fig. 13).

Electric Cooling Fan/Shroud

Disassembly

(1) Remove cooling fan/shroud assembly from vehicle. Refer to

Electric Cooling Fan Removal.

(2) Remove fan blade module retaining clip (Fig. 17).

(3) Remove fan blade module (Fig. 17).

(4) Remove fan motor wire connector from clips in shroud (Fig. 17).

(5) Remove fan motor to shroud mounting screws (Fig. 17).

Assembly

(1) Install fan motor on shroud. Tighten mounting screws.

(2) Place fan motor wire harness into clips in fan shroud.

The bushing at the fan module center has a small groove on the bottom side of it (Fig. 18) that fits over the alignment pin in the fan motor shaft (Fig. 19).

(3) Install fan module onto fan motor shaft.

(4) Install fan blade module retaining clip.

(5) Install fan shroud assembly into vehicle. Refer to Electric Cooling Fan Installation.

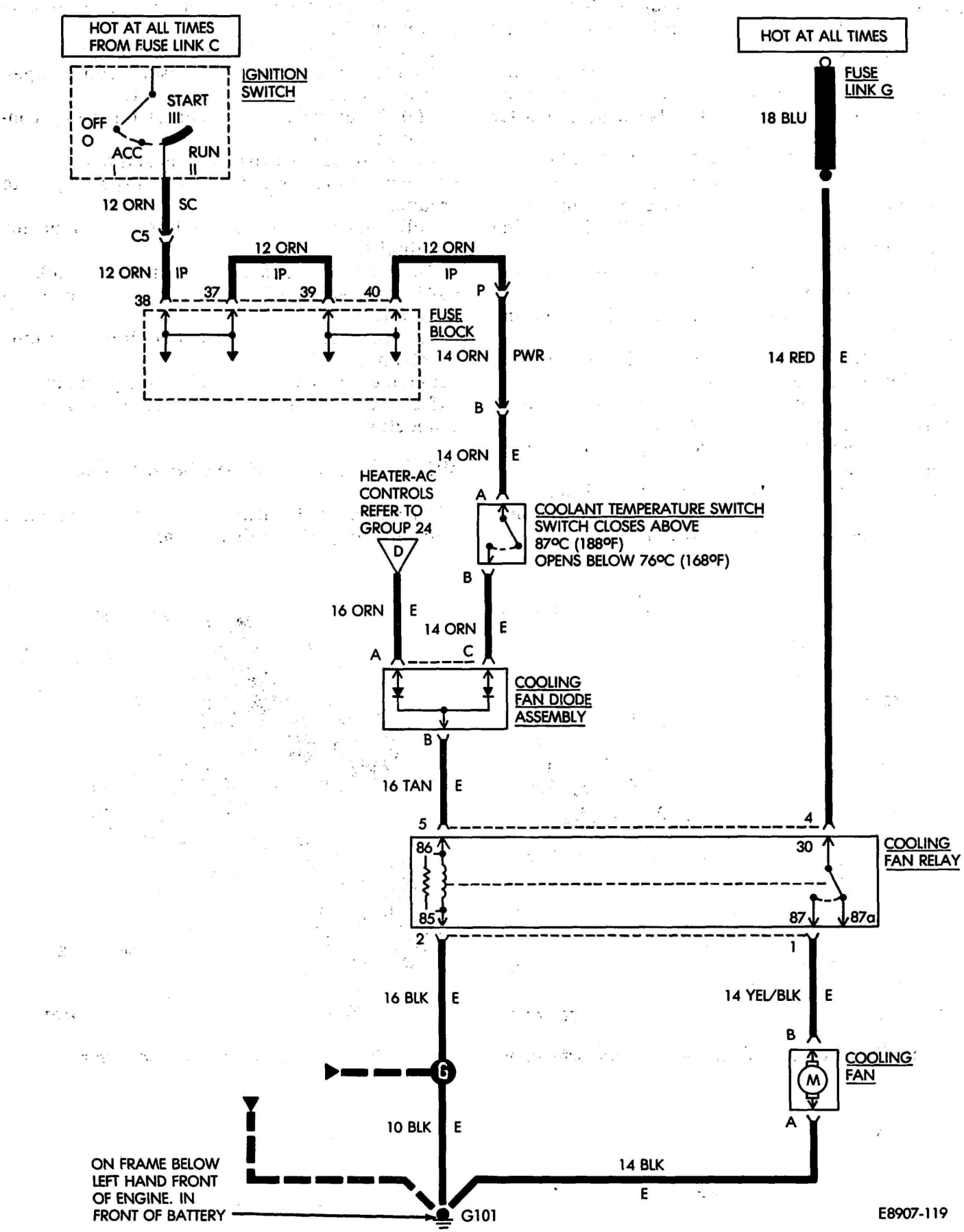


Fig. 12—Cooling Fan Schematic

Electric Cooling Fan Motor Inoperative

Refer to (Fig. 12) for terminal locations during test procedure.

If cooling fan does not operate with the A/C on, but the A/C compressor operates, repair open between terminal 5 of the cooling fan relay connector and the A/C clutch relay.

(1) COOLING FAN TEMPERATURE SWITCH: Ignition Switch in Run Position.

Connect a jumper wire between coolant temperature switch terminals A and B. The cooling fan should operate.

- If cooling fan operates, replace cooling fan temperature switch.
- If cooling fan does not operate, check cooling fan relay.

(2) COOLING FAN RELAY: Ignition Switch in Run Position, Relay Plugged in.

Connect a jumper wire between coolant temperature switch terminals A and B.

(a) Check voltage at cooling fan relay connector terminal 5.

- If battery voltage is present, proceed to (b).
- If battery voltage is not present, repair open between terminal 5 and ignition switch.

(b) Test voltage at cooling fan relay connector terminal 4.

- If battery voltage is present, proceed to (c).
- If battery voltage is not present, repair open between terminal 4 and fuse link G.

(c) Check voltage at cooling fan relay connector terminal 2.

- If zero voltage is present, proceed to (d).
- If zero voltage is not present, repair open to ground.

(d) Check voltage at cooling fan connector terminal 1.

- If battery voltage is present, proceed to (e).
- If battery voltage is not present, replace cooling fan relay.

(e) Inspect connections at cooling fan motor for clean tight fit.

- If connections are OK, replace cooling fan.
- If connections are not OK, repair or replace connections.

AUTOMATIC TRANSMISSION OIL COOLERS

For automatic transmission oil cooler service, refer to Group 21 of this manual.

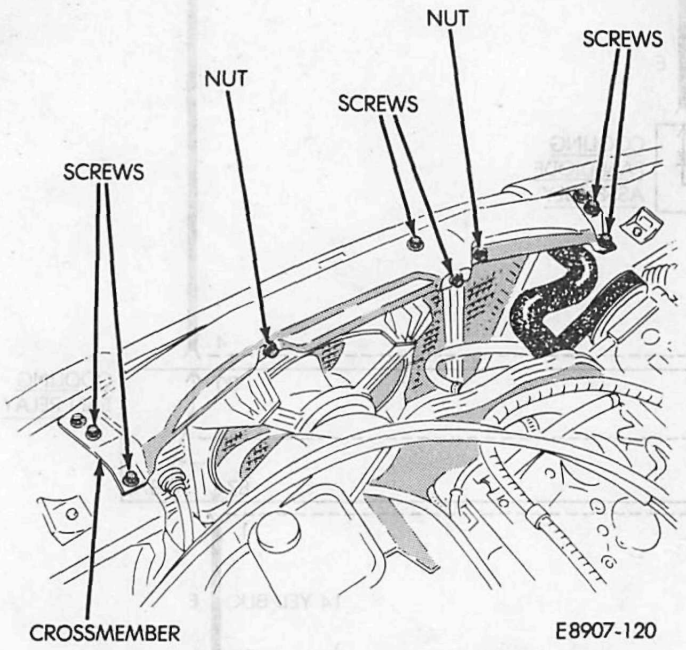


Fig 13—Radiator Crossmember Removal/Installation

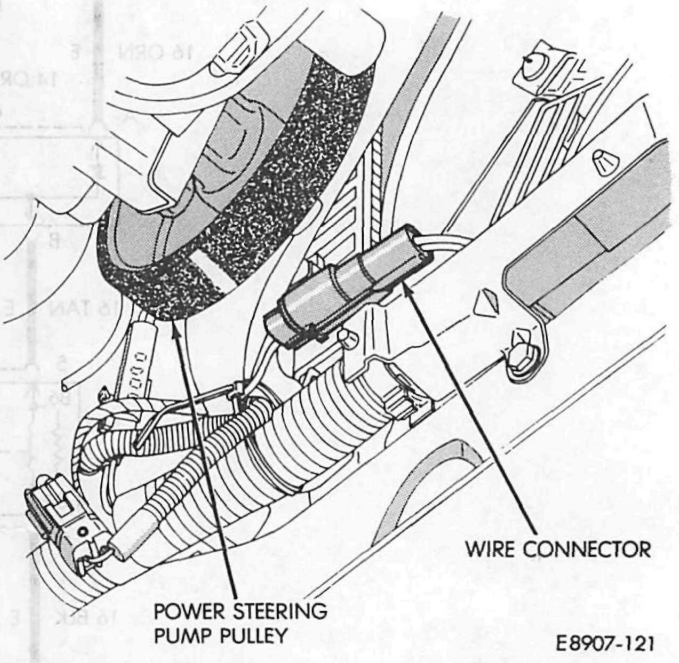


Fig. 14—Fan Motor Wire Connector

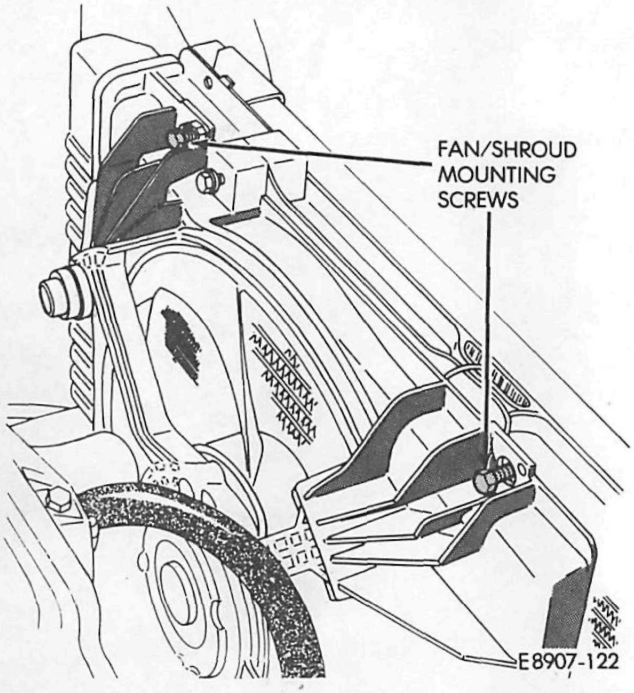


Fig. 15—Fan/Shroud Assembly Removal/Installation

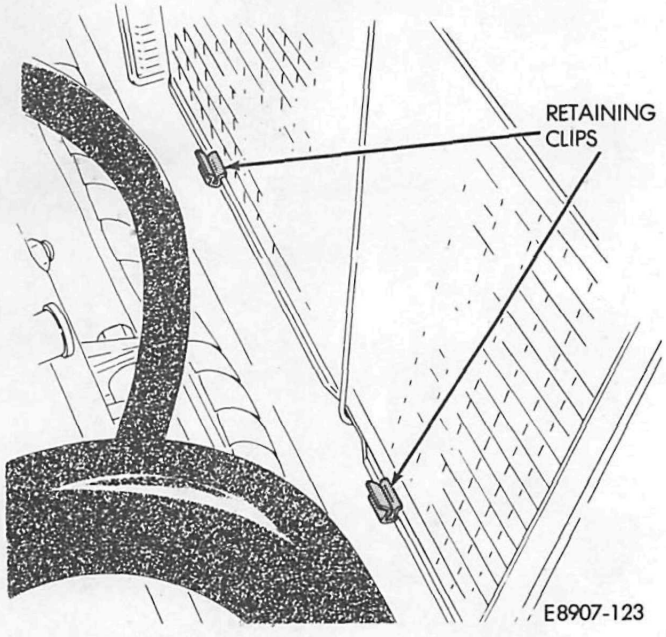


Fig. 16—Fan Shroud Retaining Clips

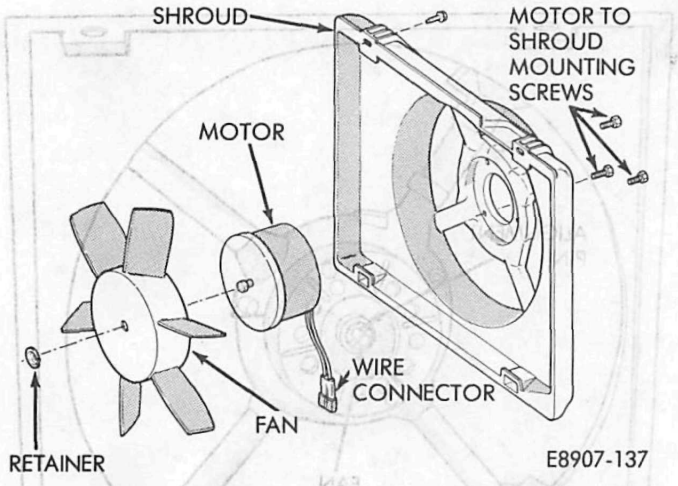


Fig. 17—Electric Cooling Fan (Typical)

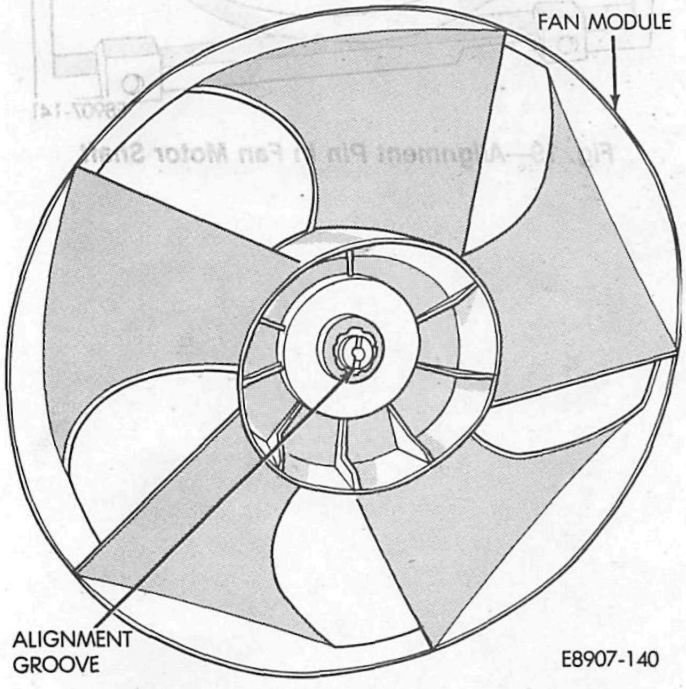


Fig. 18—Fan Module Alignment Groove

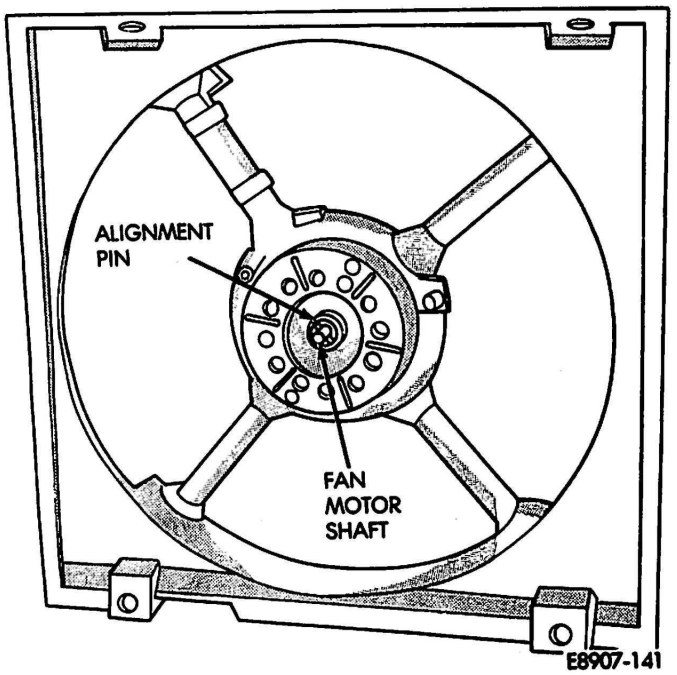


Fig. 19—Alignment Pin in Fan Motor Shaft

ACCESSORY DRIVE BELTS

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SERPENTINE DRIVE BELT DIAGNOSIS

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib are considered normal and not a reason to replace the belt. **However, cracks running along a rib (not across) are not normal. Any belt with cracks running along a rib must be replaced (Fig. 1).**

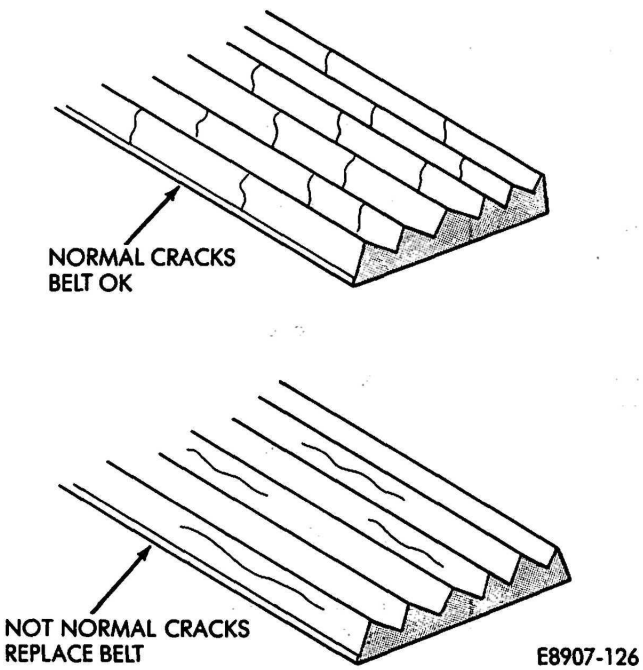


Fig. 1—Serpentine Accessory Drive Belt Wear Patterns

Refer to the following Serpentine Drive Belt diagnosis charts for further belt diagnosis.

Condition	Possible Cause	Correction
RIB CHUNKING (ONE OR MORE RIBS HAS SEPARATED FROM BELT BODY)	(1) Foreign objects imbedded in pulley grooves.	(1) Remove foreign objects from pulley grooves. Replace belt.
	(2) Installation damage.	(2) Replace belt.
RIB OR BELT WEAR	(1) Pulley(s) misaligned.	(1) Align pulley(s).
	(2) Abrasive environment.	(2) Clean pulley(s). Replace belt if necessary.
	(3) Rusted pulley(s).	(3) Clean rust from pulley(s).
	(4) Sharp or jagged pulley groove tips.	(4) Replace pulley.
	(5) Rubber deteriorated.	(5) Replace belt.
LONGITUDINAL BELT CRACKING (CRACKS BETWEEN TWO RIBS)	(1) Belt has mistracked from pulley groove.	(1) Replace belt.
	(2) Pulley groove tip has worn away rubber to tensile member.	(2) Replace belt.
BELT SLIPS	(1) Belt slipping because of insufficient tension.	(1) Adjust tension.
	(2) Belt or pulley subjected to substance (belt dressing, oil, ethylene glycol) that has reduced friction.	(2) Replace belt and clean pulleys.
	(3) Driven component bearing failure.	(3) Replace faulty component bearing.
	(4) Belt glazed and hardened from heat and excessive slippage.	(4) Replace belt.
"GROOVE JUMPING" (BELT DOES NOT MAINTAIN CORRECT POSITION ON PULLEY)	(1) Belt tension either too high or too low.	(1) Adjust belt tension.
	(2) Pulley(s) not within design tolerance.	(2) Replace pulley(s).
	(3) Foreign object(s) in grooves.	(3) Remove foreign objects from grooves.
	(4) Pulley misalignment.	(4) Align pulley(s).
	(5) Belt cordline is broken.	(5) Replace belt.
BELT BROKEN (NOTE: IDENTIFY AND CORRECT PROBLEM BEFORE NEW BELT IS INSTALLED)	(1) Excessive tension.	(1) Replace belt and adjust tension to specification.
	(2) Tensile members damaged during belt installation.	(2) Replace belt.
	(3) Severe misalignment.	(3) Align pulley(s).
	(4) Bracket, pulley, or bearing failure.	(4) Replace defective component and belt.
NOISE (OBJECTIONAL SQUEAL, SQUEAK, OR RUMBLE IS HEARD OR FELT WHILE DRIVE BELT IS IN OPERATION)	(1) Belt slippage.	(1) Adjust belt.
	(2) Bearing noise.	(2) Locate and repair.
	(3) Belt misalignment.	(3) Align belt/pulley(s).
	(4) Belt-to-pulley mismatch.	(4) Install correct belt.

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Condition	Possible Cause	Correction
NOISE (OBJECTIONAL SQUEAL, SQUEAK, OR RUMBLE IS HEARD OR FELT WHILE DRIVE BELT IS IN OPERATION) (Continued)	(5) Driven component induced vibration.	(5) Locate defective driven component and repair.
	(6) System resonant frequency induced vibration.	(6) Vary belt tension within specifications. Replace belt.
TENSION SHEETING FABRIC FAILURE (WOVEN FABRIC ON OUTSIDE CIRCUMFERENCE OF BELT HAS CRACKED OR SEPARATED FROM BODY OF BELT)	(1) Tension sheeting contacting stationary object.	(1) Correct rubbing condition.
	(2) Excessive heat causing woven fabric to age.	(2) Replace belt.
	(3) Tension sheeting splice has fractured.	(3) Replace belt.
CORD EDGE FAILURE (TENSILE MEMBER EXPOSED AT EDGES OF BELT OR SEPARATED FROM BELT BODY)	(1) Excessive tension.	(1) Adjust belt tension.
	(2) Belt contacting stationary object.	(2) Correct as necessary.
	(3) Pulley(s) out of tolerance.	(3) Replace pulley.
	(4) Insufficient adhesion between tensile member and rubber matrix.	(4) Replace belt and adjust tension to specifications.

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ACCESSORY DRIVE BELT SERVICE

Accessory Drive Belt Schematics

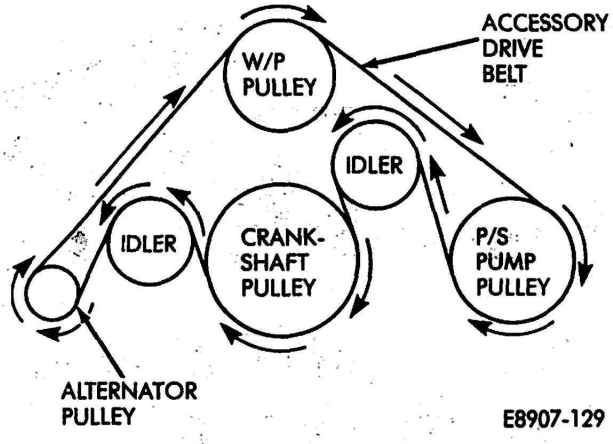


Fig. 2—Engine Without A/C

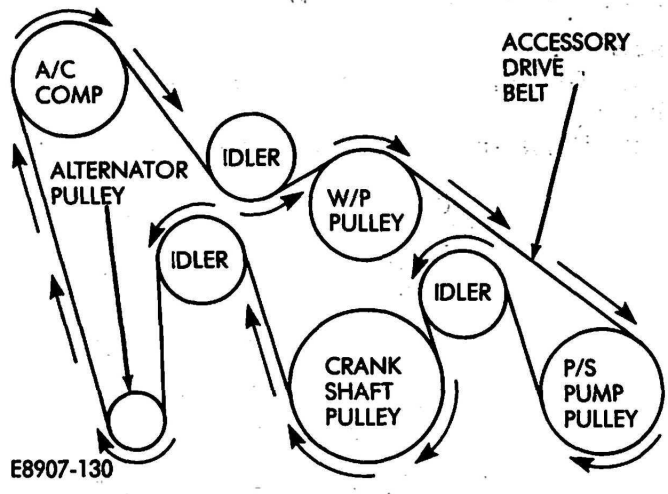


Fig. 3—3.0L Engine With A/C

Proper Belt Tension

Correct accessory drive belt tension is required to ensure optimum performance of the belt driven engine accessories. There are different gauges for checking serpentine and V type belts. Use belt tension gauge, number 7198, or an equivalent gauge, when checking belt tension. Place gauge in the middle of the section of belt being used to check tension. For correct gauge measurement, the gauge must not contact any component other than the drive belt. With the gauge fully seated on the belt, release the gauge handle as rapidly as possible to ensure a correct tension reading.

CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. It is possible to route the belt incorrectly and rotate the water pump in the opposite direction causing the engine to overheat. Refer to the appropriate accessory drive belt schematic in this section for the correct routing.

Belt Tension Specifications

Proper belt tension for a new serpentine accessory drive belt is 800-900 N (180-200 lbs-f). For a used serpentine accessory drive belt, proper belt tension is 623-712 N (140-160 lbs-f).

3.0L Accessory Drive Belt

Removal

(1) Disconnect battery negative cable from battery.

(2) Raise the vehicle on a hoist (see Group 0 Introduction for vehicle lifting information).

(3) Remove splash shield below alternator.

(4) Loosen alternator pivot bolt (Fig. 4).

(5) Loosen locking bolt (Fig. 4).

(6) Loosen adjusting bolt (Fig. 4) until the belt can be removed from the alternator pulley.

(7) Lower the vehicle.

(8) Remove locknuts securing engine damper mounting bracket to engine (Fig. 5). Push the bracket towards the engine.

(9) Remove the accessory drive belt.

Installation

CAUTION: The accessory drive belt must be routed correctly. It is possible to install the belt incorrectly and rotate the water pump in the opposite direction causing the engine to overheat. Refer to the appropriate accessory drive belt schematic in this section for correct belt routing.

(1) If any of the idler pulleys were removed, they must be installed with the small spacer washer between the pulley and the engine (Fig. 6). The inside bushing is installed between the pulley and locknut.

(2) Install the accessory drive belt on the pulleys.

(3) Install engine damper mounting bracket onto studs in engine front cover (Fig. 5). Tighten locknuts to 40 N·m (30 ft-lbs) torque.

(4) Raise the vehicle.

(5) Tighten the alternator pivot bolt to 50 N· (37 ft-lbs) torque (Fig. 4)

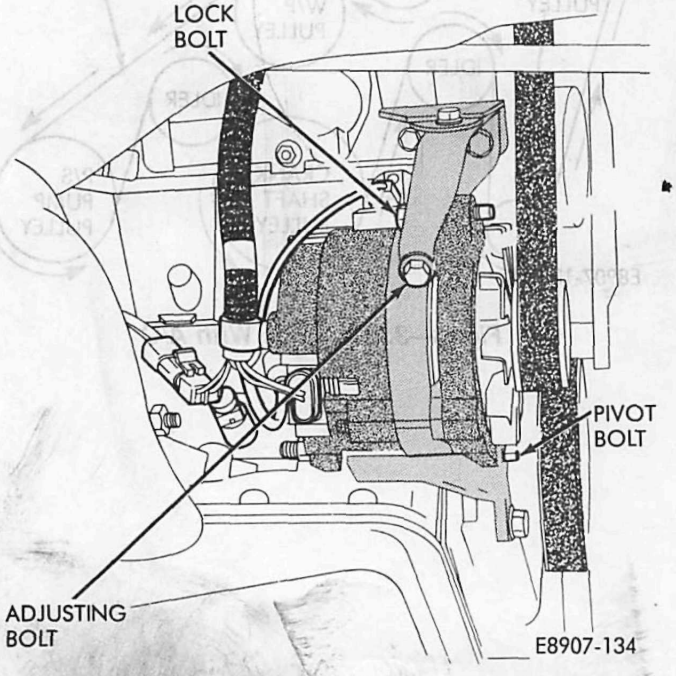


Fig. 4—Alternator Pivot Bolt, Lockbolt and Adjusting Bolt—3.0L Engine

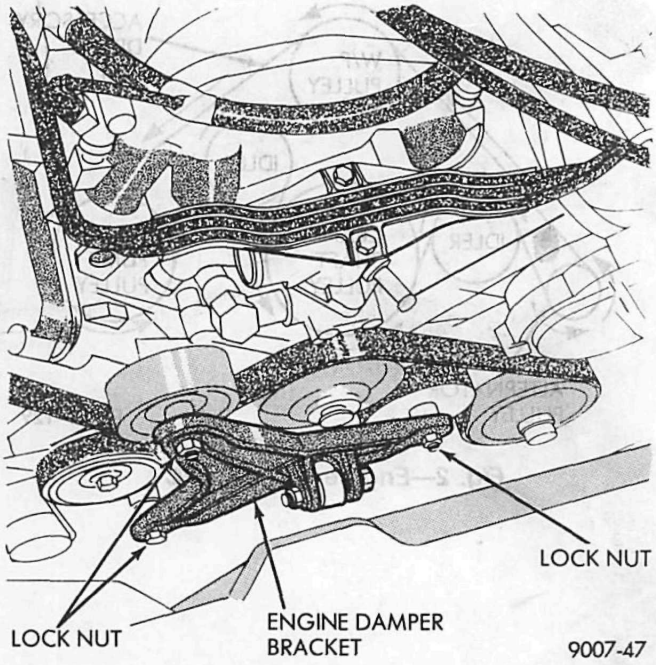


Fig. 5—Engine Damper Mounting Bracket—3.0L Engine

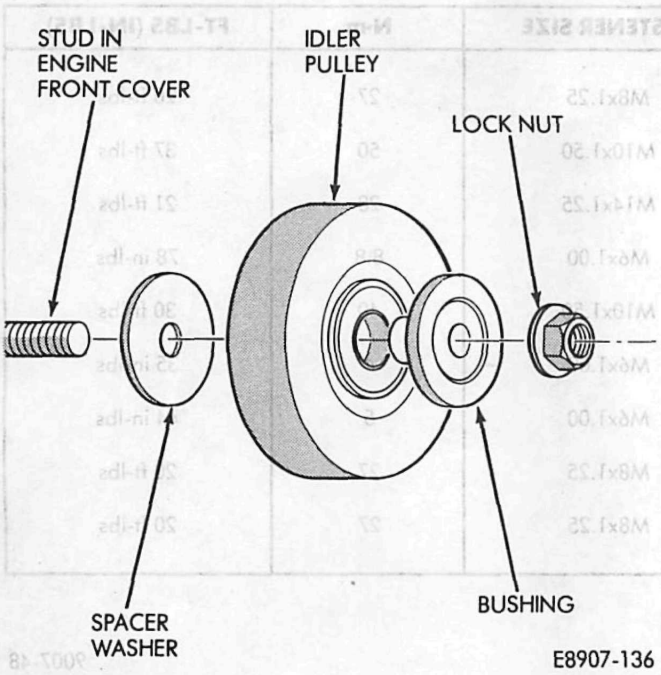


Fig. 6—Idler Pulley Assembly—3.0L Engine

(6) The belt tension gauge must be installed in the middle of the span of belt that is used to check belt tension (Fig. 7).

(a) On vehicles with air conditioning, install belt tension gauge 7198 in the middle of the drive belt span between the air conditioning compressor and the alternator.

(b) On vehicles without air conditioning, install belt tension gauge 7198 in the middle of the drive belt between the water pump and the alternator.

Tighten adjusting bolt (Fig. 4) until the correct belt tension is obtained. Refer to Belt Tension Specifications in this section for belt tension specifications.

If a new belt is installed, it should be tensioned after 12 070 km (7500 miles) of usage.

(7) Tighten locking bolt (Fig. 4) to 27 N·m (20 ft-lbs) torque.

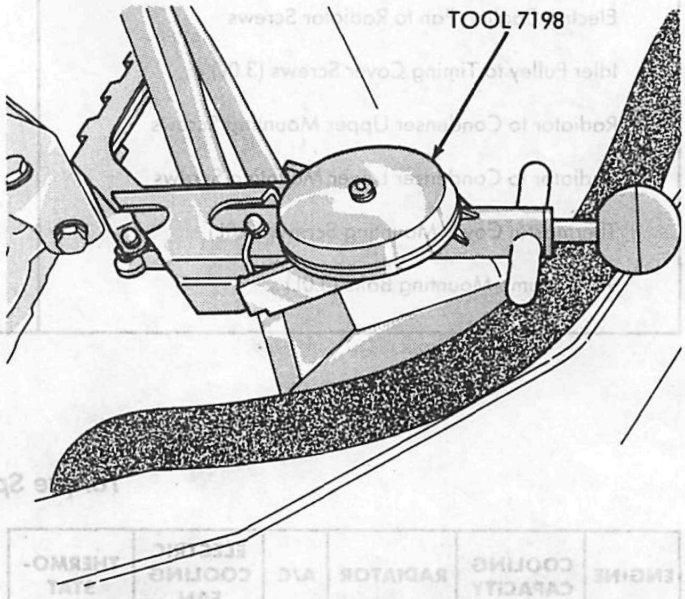


Fig. 7—Checking Belt Tension—3.0L Engine

(8) Tighten alternator pivot bolt (Fig. 5) to 50 N·m (37 ft-lbs) torque.

(9) Install the splash shield.

(10) Lower the vehicle.

(11) Connect negative cable to battery.

COMPONENT	FASTENER SIZE	N·m	FT-LBS (IN-LBS)
Alternator Locking Bolt (3.0L)	M8x1.25	27	20 ft-lbs
Alternator Pivot Bolt (3.0L)	M10x1.50	50	37 ft-lbs
Coolant Temperature Sensor	M14x1.25	28	21 ft-lbs
Electric Cooling Fan to Radiator Screws	M6x1.00	8.8	78 in-lbs
Idler Pulley to Timing Cover Screws (3.0L)	M10x1.50	40	30 ft-lbs
Radiator to Condenser Upper Mounting Screws	M6x1.00	4	35 in-lbs
Radiator to Condenser Lower Mounting Screws	M6x1.00	5	44 in-lbs
Thermostat Cover Mounting Screws (3.0L)	M8x1.25	27	20 ft-lbs
Water Pump Mounting Bolts (3.0L)	M8x1.25	27	20 ft-lbs

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Torque Specifications

ENGINE	COOLING CAPACITY		RADIATOR		A/C	ELECTRIC COOLING FAN		THERMO-STAT	
3.0L	Qts.	L	Rows Of Tubes	Fins Per Inch		Dia. (Inch)	No. Of Blades	Starts To Open At	Fully Open At
	8.7	8.2L	1	23	•	14.6	5	190°F	214°F

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Cooling Specifications

ELECTRICAL

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CHARGING SYSTEM 8C
ELECTRIC LOCKS 8P
EXTERIOR LAMPS 8L
HORNS 8G
IGNITION SYSTEM 8D
INSTRUMENT PANELS AND GAUGES 8E
POWER MIRRORS 8T
POWER SEATS 8R
POWER WINDOWS 8S
RADIO, ANTENNA AND SPEAKERS 8F
REAR WINDOW DEFOGGER 8N
RESTRAINT SYSTEMS 8M
SPEED CONTROL 8H
STARTING SYSTEM 8B
TURN SIGNALS AND FLASHERS 8J
WINDSHIELD WIPERS AND WASHERS 8K
WIRING DIAGRAMS 8W

Throughout this group, references may be made to a particular vehicle by letter or number designation. A chart showing the breakdown of these designations is included in Introduction Section at front of this service manual.

BATTERY

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BATTERY TEST PROCEDURES

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GENERAL INFORMATION

The battery stores, stabilizes, and produces electrical current to operate various electrical systems. The determination of whether a battery is good or bad is made by the batteries ability to accept a charge and produce high-amperage current output over an extended period. The capability of the battery to store electrical current comes from a chemical reaction between the sulfuric acid solution (electrolyte) and the lead +/– plates in each cell of the battery. As the battery discharges, the plates collect the acid from the electrolyte. When the charging system charges the battery, the acid is forced out of the plates into the electrolyte. The amount of acid (specific gravity) in the electrolyte can be measured with a hydrometer. A factory installed battery is equipped with a built-in hydrometer (test indicator) to assist in determining the state-of-charge. The factory installed battery is also nonrefillable, water cannot be added. The battery is vented to release gases that are created when the battery is being charged. The battery top, posts, and terminals should be cleaned when other underhood maintenance is performed (Fig. 1).

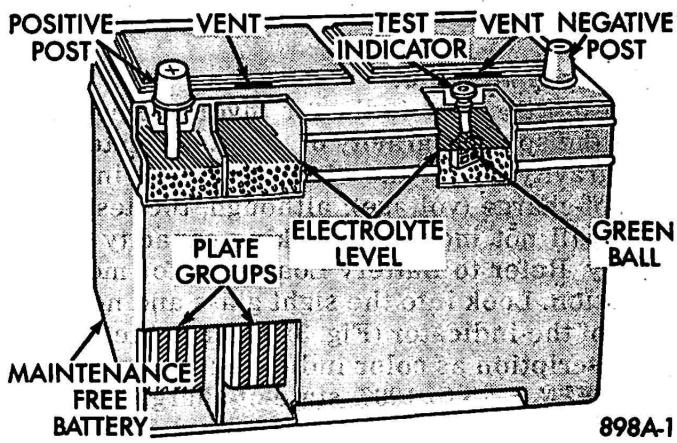


Fig. 1—Battery Construction and Test Indicator

WARNING: DO NOT ATTEMPT TO ASSIST BOOST, CHARGE, OR TEST BATTERY WHEN ELECTROLYTE LEVEL IS BELOW THE TOP OF THE PLATES. PERSONAL INJURY MAY OCCUR.

When the electrolyte level is below the top of the plates (yellow or bright color indicator dot), the battery must be replaced. The battery must be completely charged (green dot) and the top, posts, and terminals should be properly cleaned before diagnostic procedures are performed, see Group 8B, Battery/Starter Service, for additional information.

TEST INDICATOR

A test indicator (hydrometer) built in to the top of battery case, provides visual information for battery testing (Fig. 2). The test indicator is to be used with diagnostic procedures described in this group.

It is important when using test indicator that battery be relatively level and have a clean top to see correct indications. A light may be required to view indicator.

WARNING: DO NOT USE OPEN FLAME. EXPLOSIVE GASES FORM ABOVE BATTERY.

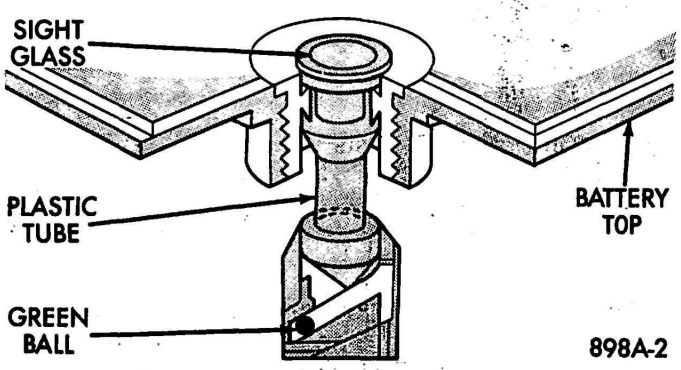


Fig. 2—Built In Test Indicator

STATE OF CHARGE TESTS

Using Test Indicator

The built-in test indicator (hydrometer) measures the specific gravity of the electrolyte. Specific gravity (sg) of the electrolyte will indicate state-of-charge (voltage); although, the test indicator will not indicate cranking capacity of the battery. Refer to Battery Load Test for more information. Look into the sight glass and note the color of the indicator (Fig. 3), refer to the following description as color indicates:

GREEN = 75 to 100% state-of-charge

The battery is adequately charged for further testing or return to use. If the vehicle will not crank for a maximum 15 seconds, refer to Battery Load Test for more information.

BLACK OR DARK = 0 to 75% state-of-charge

The battery is inadequately charged and must be charged until green dot is visible (12.4 volts or greater) before the battery is tested or returned to use, refer to Causes of Battery Discharging for more information.

WARNING: DO NOT ATTEMPT TO CHARGE, TEST, OR ASSIST BOOST BATTERY WHEN YELLOW OR BRIGHT COLOR DOT IS VISIBLE. PERSONAL INJURY MAY OCCUR.

YELLOW OR BRIGHT COLOR

A yellow or bright color dot indicates water (electrolyte) level in battery is below the test indicator (Fig. 3). Water can not be added to a maintenance free battery. The battery must be replaced. A low electrolyte level may be caused by an over charging condition. Refer to Group 8C, Alternator.

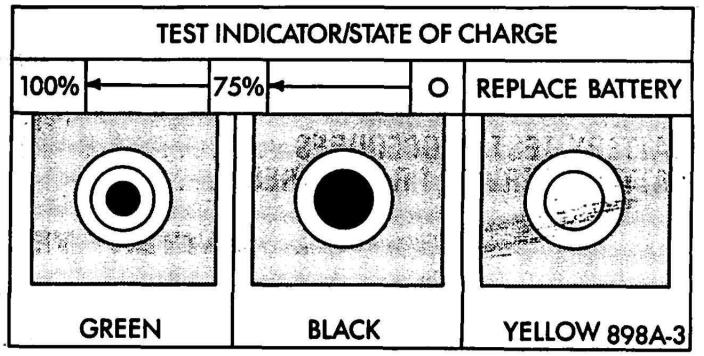


Fig. 3—Test Indicator Sight Glass

CAUSES OF BATTERY DISCHARGING

It is normal for a Chrysler Motors vehicle to have a small (5 to 35 milliamperes) continuous electrical draw from the battery with the ignition in the OFF position, and the courtesy, dome, storage compartments, and engine compartment lights OFF. The continuous draw is due to various electronic features or accessories that require electrical current with the ignition OFF to function properly. When a vehicle is not used over an extended period (20 days) the main fusible link connector (Fig. 5), located behind the battery on the engine wiring harness, should be disconnected. This will prevent battery discharge.

Abnormal Battery Discharging

(1) Corroded battery posts and terminals.

(2) Loose or worn alternator drive belt.

(3) Electrical loads that exceed the output of the charging system due to equipment or accessories installed after delivery.

(4) Slow driving speeds (heavy traffic conditions) or prolonged idling with high-amperage electrical systems in use.

(5) Defective electrical circuit or component causing excess Ignition Off Draw (IOD).
(6) Defective charging system.
(7) Defective battery.

IGNITION OFF DRAW (IOD) TESTS

A normal vehicle electrical system will draw 5 to 35 milliamperes from the battery, with the ignition in the OFF position and all nonignition controlled circuits in proper working order. A vehicle that has not been operated for an extended period of time (20 days) may discharge the battery to an inadequate level. In this case, the main fusible link connector should be disconnected. The main fusible link connector is located rearward of the battery on the engine wiring harness (Fig. 5). If the IOD is excessive (over 35 milliamperes), the defect must be found and corrected.

Ignition Off Draw Tests

To test for excessive IOD, verify that all electrical accessories are OFF. Turn off all lights, remove ignition key, and close all doors and decklid. If the vehicle is equipped with electronic accessories (illuminated entry, automatic load leveler, body computer, or high line radio), allow the systems to automatically shut off (time out), up to 3 minutes.

(1) Raise the hood and disconnect both battery cables, negative first (Fig. 4).

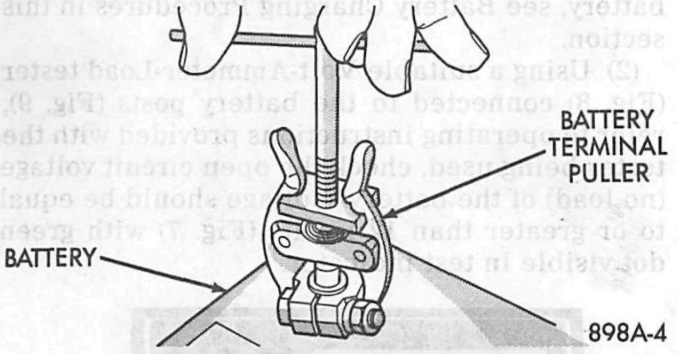


Fig. 4—Disconnect Battery Cables

(2) Connect the negative cable and connect a typical 12-volt test light (low wattage bulb) between the positive cable clamp and the positive battery post (Fig. 5). Remove the engine compartment lamp bulb. If the test light does not light, proceed to step 3. If the test light does light, proceed to step 4. The test light will indicate IOD greater than 2 amps.

After higher amperage IOD has been corrected, proceed to step 3.

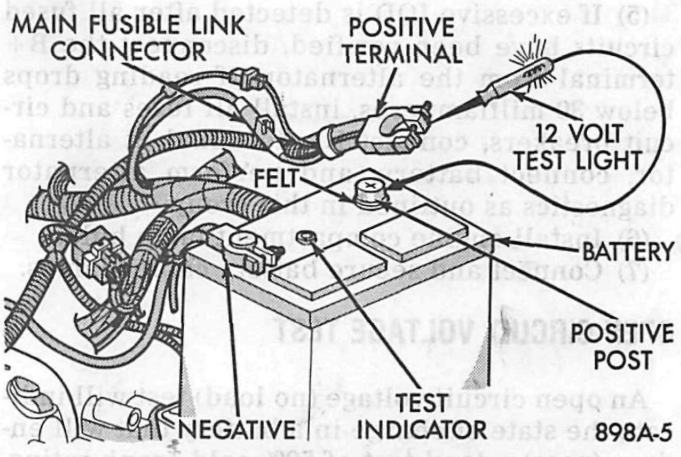


Fig. 5—High Amperage IOD Test

CAUTION: IOD greater than 2 amps may damage milliampmeter.

The headlamp system will momentarily draw current in excess of 35 milliamperes that will damage a milliampere meter. Leave the test light connected when connecting the meter.

(3) With 12-volt test light still connected (not lit, see step 2), connect an ammeter (milliampere scale) between the positive cable clamp and the positive battery post (Fig. 6), disconnect test light, refer to instructions provided with ammeter being used. A reading of 35 milliamperes or less indicates normal electrical draw. If ammeter reads more than 35 milliamperes, excessive IOD must be corrected.

(4) Locate the fuse panel and remove fuses or circuit breakers one at a time, and observe ammeter after each fuse or circuit breaker is removed. If test light goes out and the reading drops below 35 milliamperes when a certain fuse or circuit breaker is removed, that circuit may have a defect. Refer to Group 8W, Wiring Diagrams, for component and splice locations.

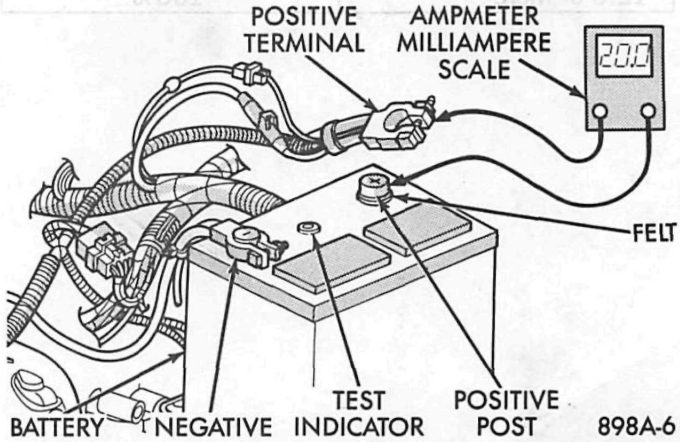


Fig. 6—Low Amperage IOD Test

(5) If excessive IOD is detected after all fused circuits have been verified, disconnect the B+ terminal from the alternator. If reading drops below 30 milliamperes, install all fuses and circuit breakers, connect B+ terminal at alternator, connect battery, and perform alternator diagnostics as outlined in this group.

(6) Install engine compartment lamp bulb.

(7) Connect and secure battery cable clamps.

OPEN CIRCUIT VOLTAGE TEST

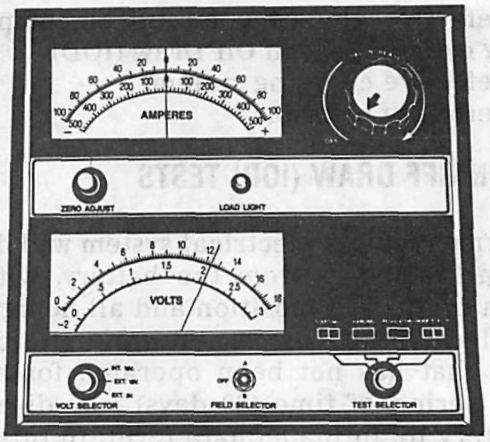
An open circuit voltage (no load) test will indicate the state of charge in a battery that will endure (pass) a load test of 50% cold crank rating, see Battery Load Test in this section. If a battery has an open circuit voltage reading of 12.4 volts or greater and will not endure a load test, it is defective and replacement would be required. To test open circuit voltage, perform the following operation:

(1) Remove both battery cables, negative first (Fig. 4). If the battery has been boosted, charged, or loaded just prior to this operation, allow the battery time to stabilize.

(2) Using a voltmeter connected to the battery posts, see instructions provided with voltmeter being used, measure open circuit voltage (Fig. 7).

This voltage reading will indicate state of charge, but will not reveal cranking capacity. Refer to Battery Open Circuit Voltage chart.

OPEN CIRCUIT VOLTAGE	
Open Circuit Volts	**Percent Charge**
11.7 volts or less	0%
12.0	25%
12.2	50%
12.4	75%
12.6 or more	100%



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Fig. 7—Testing Open Circuit Voltage

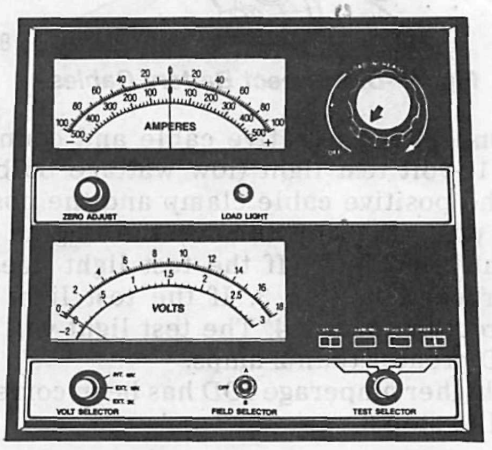
BATTERY LOAD TEST

A battery must have the reserve cranking capacity to supply the starter motor and ignition system enough power to start the engine over a broad range of ambient temperatures. A battery load test will verify the actual cranking performance based on the cold crank rating of the battery.

WARNING: IF BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR EXCESSIVELY LOW ELECTROLYTE LEVEL, DO NOT TEST. ACID BURNS OR EXPLOSIVE CONDITION MAY RESULT.

(1) Remove both battery cables, negative first (Fig. 4). Battery top and posts should be clean. If green dot is not visible in indicator, charge the battery, see Battery Charging Procedures in this section.

(2) Using a suitable Volt-Ammeter-Load tester (Fig. 8) connected to the battery posts (Fig. 9), refer to operating instructions provided with the tester being used, check the open circuit voltage (no load) of the battery. Voltage should be equal to or greater than 12.4 volts (Fig. 7) with green dot visible in test indicator.



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Fig. 8—Volt-Ammeter-Load Tester (Typical)

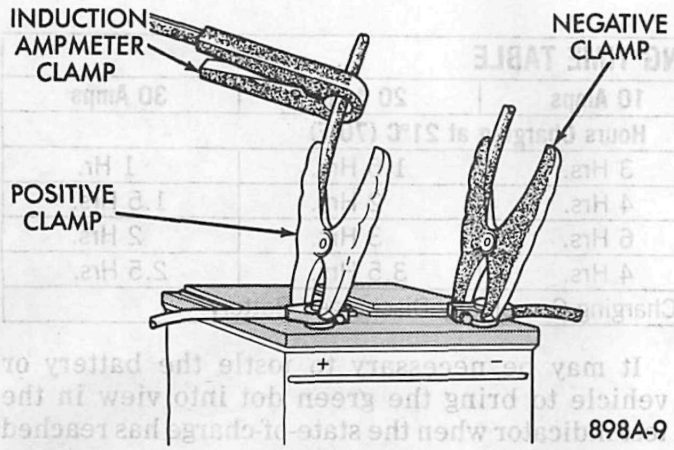


Fig. 9—Volt-Ammeter-Load Tester Connections

(3) Rotate the load control knob (Carbon pile rheostat) to apply a 300 amp load for 15 seconds to remove the surface charge from the battery and return the control knob to off (Fig. 10).

(4) Allow the battery to stabilize for 15 seconds, verify open circuit voltage.

(5) Rotate the load control knob to maintain a load (50% of cold crank rating—see specifications) for a minimum 15 seconds (Fig. 11). After 15 seconds, record the (loaded) voltage reading and return the load control to off.

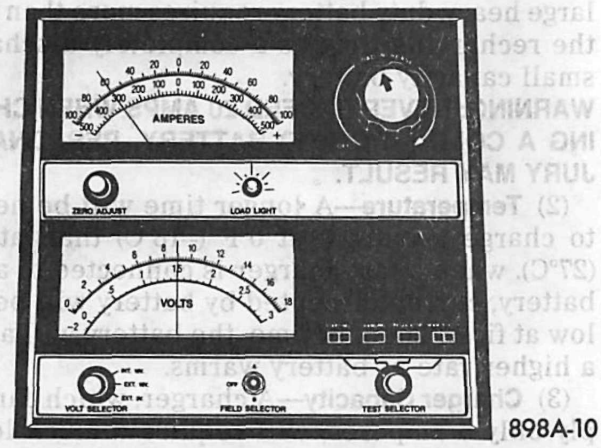


Fig. 10—Remove Surface Charge from Battery

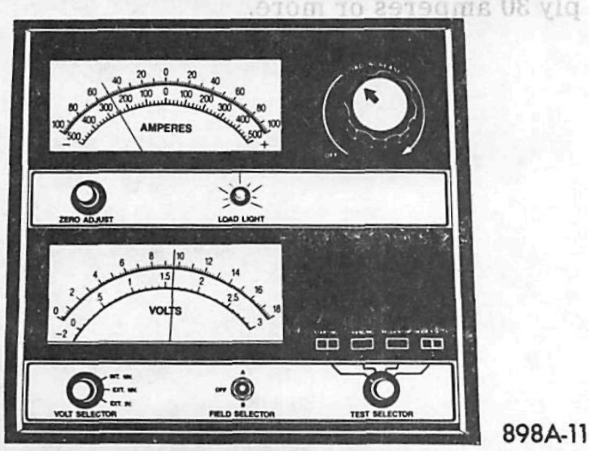


Fig. 11—Load 50% Cold Crank Rating Note Voltage

(6) Voltage drop will vary according to battery temperature at the time of the load test. Battery temperature can be estimated by the temperature of exposure over the preceding several hours. If the battery has been charged, boosted, or loaded a few minutes prior to test, the battery would be somewhat warmer. Refer to Load Test Temperature chart for proper loaded voltage reading.

(7) If battery passes load test, it's in good condition. No further tests are necessary. If it fails load test, it should be replaced.

LOAD TEST TEMPERATURE

Minimum Voltage	Temperature	
	F°	C°
9.6	70 and above	21 and above
9.5	60	16
9.4	50	10
9.3	40	4
9.1	30	–1
8.9	20	–7
8.7	10	–12
8.5	0	–18

CHARGING BATTERY

A battery charged to 12.4 volts or greater, with sufficient cranking capacity (minimum 9.6 volts when loaded for 15 seconds to 50% of cold cranking amperage rating at 21°C/70°F), is completely charged. A green dot, visible in the test indicator built-in to the top of the battery, indicates it is charged enough for further testing and possibly returned to use. A black dot indicates the battery voltage is below 12.4 volts and probably will accept a charge. A yellow or bright color dot indicates the battery has excessively low electrolyte level. The battery can not be refilled or charged, it must be replaced.

WARNING: DO NOT CHARGE A BATTERY THAT HAS EXCESSIVELY LOW ELECTROLYTE LEVEL. BATTERY MAY ARK INTERNALLY AND EXPLODE.

EXPLOSIVE GASES FORM OVER BATTERY, DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR BATTERY.

DO NOT ASSIST BOOST OR CHARGE A FROZEN BATTERY, CASING MAY FRACTURE.

POISON, CAUSES SEVERE BURNS. BATTERY CONTAINS SULFURIC ACID, AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. IN EVENT OF CONTACT, FLUSH WITH WATER AND CALL PHYSICIAN IMMEDIATELY. KEEP OUT OF REACH OF CHILDREN.

BATTERY CHARGING TIME TABLE				
Charging Amperage	5 Amps	10 Amps	20 Amps	30 Amps
Open Circuit Voltage	Hours Charging at 21°C (70°F)			
12.25 to 12.39	6 Hrs.	3 Hrs.	1.5 Hrs.	1 Hr.
12.00 to 12.24	8 Hrs.	4 Hrs.	2 Hrs.	1.5 Hrs.
11.95 to 12.09	12 Hrs.	6 Hrs.	3 Hrs.	2 Hrs.
10.00 to 11.95	14 Hrs.	4 Hrs.	3.5 Hrs.	2.5 Hrs.
10.00 to 0	See Charging Completely Discharged Battery			

CAUTION: Disconnect the vehicle's negative battery cable (Fig. 12) before charging battery to avoid damage to electrical systems. Do not exceed 16.0 volts while charging battery.

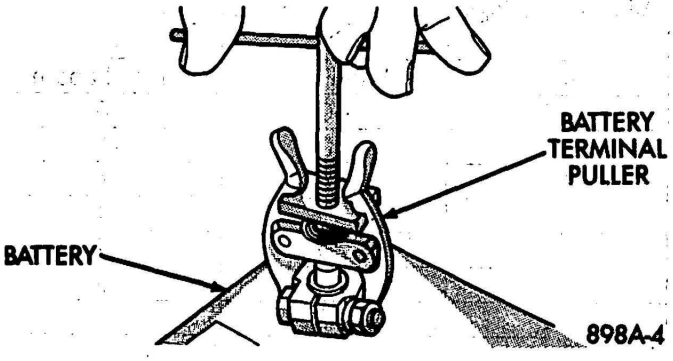


Fig. 12—Disconnect Negative Battery Cable

Battery electrolyte will bubble inside of case while being charged properly. If the electrolyte boils violently or is discharged from the vent holes while charging, immediately reduce charging rate or turn off charger and evaluate battery condition.

Some battery chargers are equipped with polarity (+ to +/– to –) sensing devices to protect the charger or battery from being damaged if improperly connected. If the battery state of charge is too low for the polarity sensor to detect, the sensor must be bypassed for charger to operate. Refer to operating instructions provided with battery charger being used.

CAUTION: Charge battery until test indicator appears green. Do not overcharge.

It may be necessary to jostle the battery or vehicle to bring the green dot into view in the test indicator when the state-of-charge has reached 12.4 volts.

After the battery has been charged to 12.4 volts or greater, perform a load test to determine cranking capacity. If the battery will endure a load test, return the battery to use. If battery will not endure a load test, it must be replaced. Properly clean and inspect battery hold downs, tray, terminals, posts, and top before completing service.

Charging Time Required

The time required to charge a battery will vary depending upon the following factors:

(1) **Size of Battery**—A completely discharged large heavy-duty battery requires more than twice the recharging time as a completely discharged small capacity battery.

WARNING: NEVER EXCEED 20 AMPS WHEN CHARGING A COLD (–1°C/30°F) BATTERY, PERSONAL INJURY MAY RESULT.

(2) **Temperature**—A longer time will be needed to charge a battery at 0°F (–18°C) than at 80°F (27°C). when a fast charger is connected to a cold battery, current accepted by battery will be very low at first. Then, in time, the battery will accept a higher rate as battery warms.

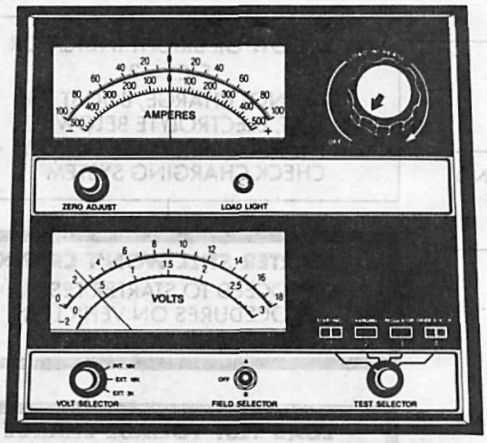
(3) **Charger Capacity**—A charger, which can supply only 5 amperes, will require a much longer period of charging than a charger that can supply 30 amperes or more.

(4) State-Of-Charge—A completely discharged battery requires more charging time than a partially charged battery. Electrolyte is nearly pure water in a completely discharged battery. At first the charging current amperage will be low. As acid is forced from the plates, inside the battery, the current amperate will rise. Also, the specific gravity of the electrolyte will rise, bringing the green dot into view.

Charging Completely Discharged Battery

The following procedure should be used to recharge a completely discharged battery. Unless procedure is properly followed, a good battery may be needlessly replaced.

(1) Measure voltage at battery posts with a voltmeter, accurate to 1/10 volt (Fig. 13). If below 10 volts, then charge current will be low and it could take some time before it accepts a current in excess of a few milliamperes. Such low current may not be detectable on amperemeters built into many chargers.



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Fig. 13—Voltmeter Accurate to 1/10 Volt Connected

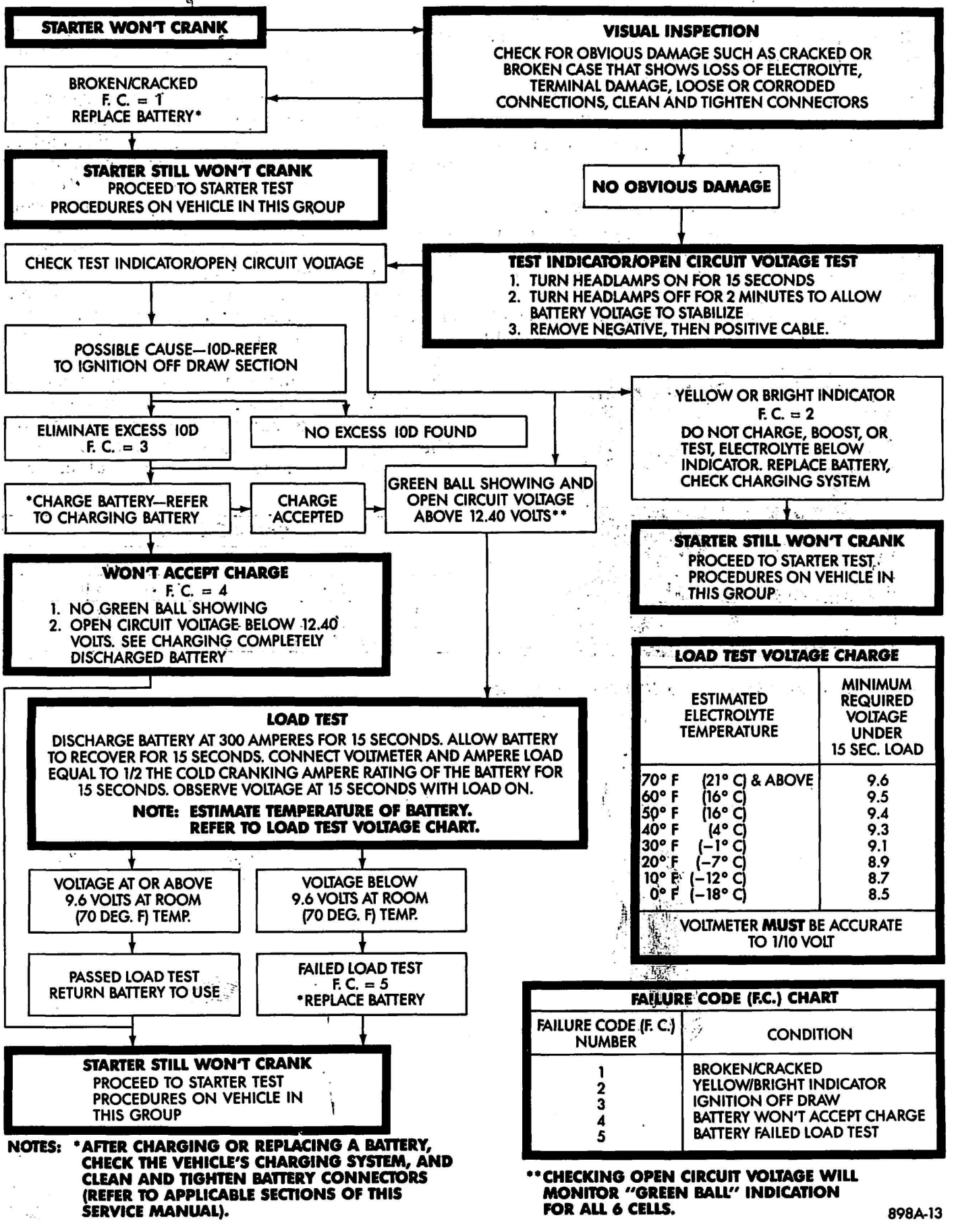
(2) Connect charger leads. Some chargers feature polarity protection circuitry which prevents operation unless charger is connected to battery posts correctly. A completely discharged battery may not have enough voltage to activate this circuitry, even though leads are connected properly, making it appear that battery will not accept charging current. Refer to instructions provided with battery charger being used.

(3) Battery chargers vary in the amount of voltage and current they provide. For time required for battery to accept measurable charger current at various voltages, refer to Charge Rate chart. If charge current is still not measurable at end of charging times, the battery should be replaced. If charge current is measurable during charging time, the battery may be good and charging should be completed in the normal manner.

CHARGE RATE

Voltage	Hours
16.0 volts or more	up to 4 hrs.
14.0 to 15.9 volts	up to 8 hrs.
13.9 volts or less	up to 16 hrs.

BATTERY DIAGNOSTICS CHART



LOAD TEST VOLTAGE CHARGE

ESTIMATED ELECTROLYTE TEMPERATURE	MINIMUM REQUIRED VOLTAGE UNDER 15 SEC. LOAD
70° F (21° C) & ABOVE	9.6
60° F (16° C)	9.5
50° F (16° C)	9.4
40° F (4° C)	9.3
30° F (−1° C)	9.1
20° F (−7° C)	8.9
10° F (−12° C)	8.7
0° F (−18° C)	8.5

VOLTMETER **MUST** BE ACCURATE TO 1/10 VOLT

FAILURE CODE (F.C.) CHART

FAILURE CODE (F. C.) NUMBER	CONDITION
1	BROKEN/CRACKED
2	YELLOW/BRIGHT INDICATOR
3	IGNITION OFF DRAW
4	BATTERY WON'T ACCEPT CHARGE
5	BATTERY FAILED LOAD TEST

NOTES: *AFTER CHARGING OR REPLACING A BATTERY, CHECK THE VEHICLE'S CHARGING SYSTEM, AND CLEAN AND TIGHTEN BATTERY CONNECTORS (REFER TO APPLICABLE SECTIONS OF THIS SERVICE MANUAL).

****CHECKING OPEN CIRCUIT VOLTAGE WILL MONITOR "GREEN BALL" INDICATION FOR ALL 6 CELLS.**

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BATTERY SERVICE PROCEDURES

REMOVAL

(1) Loosen the battery terminal clamp bolts.
(2) Use a battery terminal puller to remove the battery negative cable clamp first.
(3) Use the battery terminal puller to remove the battery positive cable clamp.
(4) Loosen and remove the battery holddown nut.
(5) Remove the battery holddown.
(6) Unsnap air cleaner holddowns (Fig. 1).

WARNING: USE EXTREME CARE TO PREVENT DROPPING THE BATTERY AND SPLATTERING THE ELECTROLYTE BECAUSE IT CAN CAUSE SEVERE EYE INJURY AND SKIN BURNS. RUBBER GLOVES, RUBBER APRONS AND PROTECTIVE EYE SHIELDS WILL DECREASE THE HAZARDS OF THIS TYPE OF ACCIDENT. IMMEDIATE FIRST AID IS REQUIRED FOR ELECTROLYTE SPLASHED INTO THE EYES AND ON THE SKIN. ELECTROLYTE SPILLS SHOULD BE NEUTRALIZED IMMEDIATELY WITH A SOLUTION OF SODIUM BICARBONATE (BAKING SODA) AND WATER AND THEN THOROUGHLY RINSED WITH WATER.

(7) Remove the battery.
(8) Inspect the battery tray and holddowns for corrosion. Remove corrosion using a stiff bristle brush and a baking soda and warm water solution (Fig. 2). Paint any exposed bare metal. Replace damaged components.
(9) Clean the outside of the battery case if the original battery is to be installed. Clean the top cover as described in Step 8. Flush with clean water. Ensure the cleaning solution does not enter the cells.
(10) Inspect the case for cracks or other damage that would result in leakage of electrolyte.
(11) Remove corrosion from battery posts and clamps with a suitable battery terminal cleaning tool (Fig. 3 or 4).

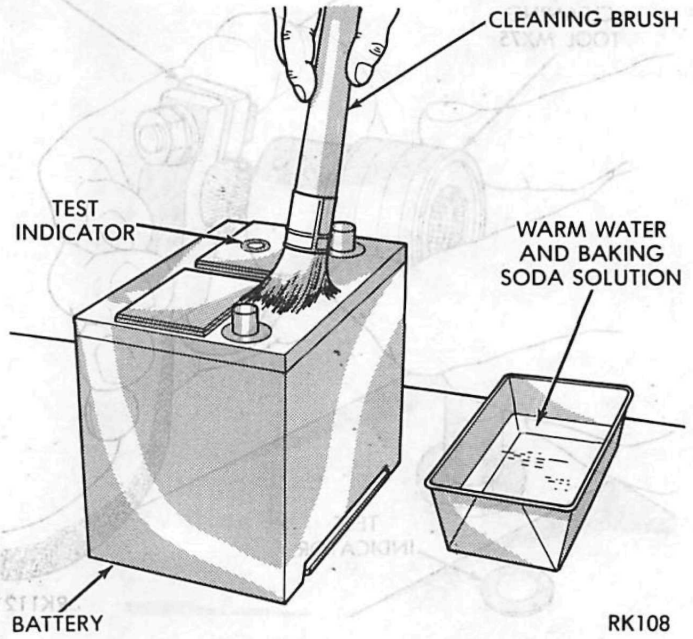


Fig. 2—Cleaning Battery

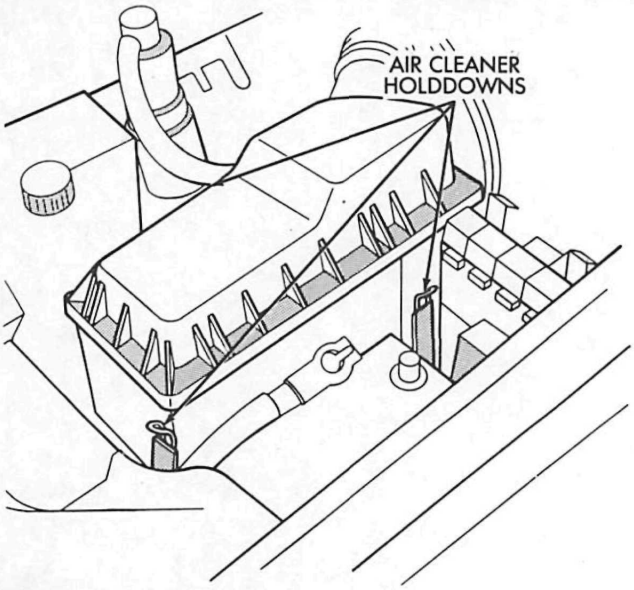


Fig. 1—Unsnap Air Cleaner Holddowns

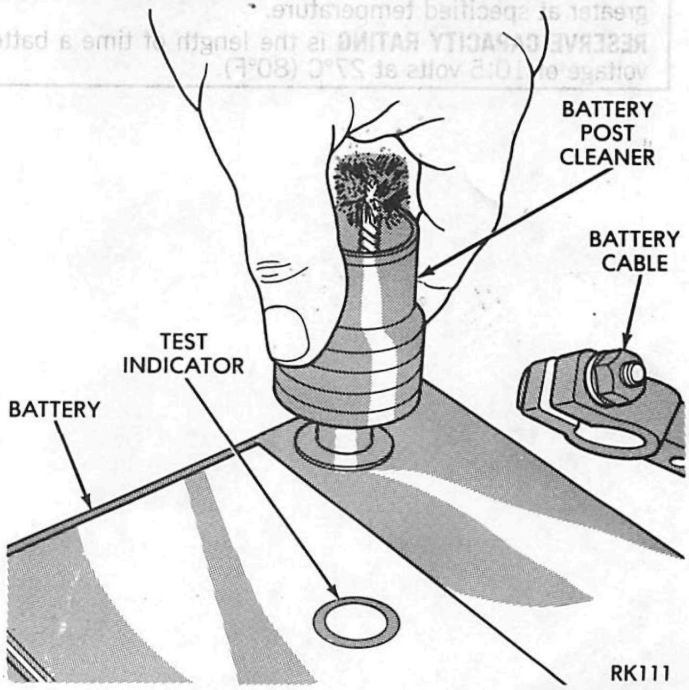


Fig. 3—Clean Battery Posts

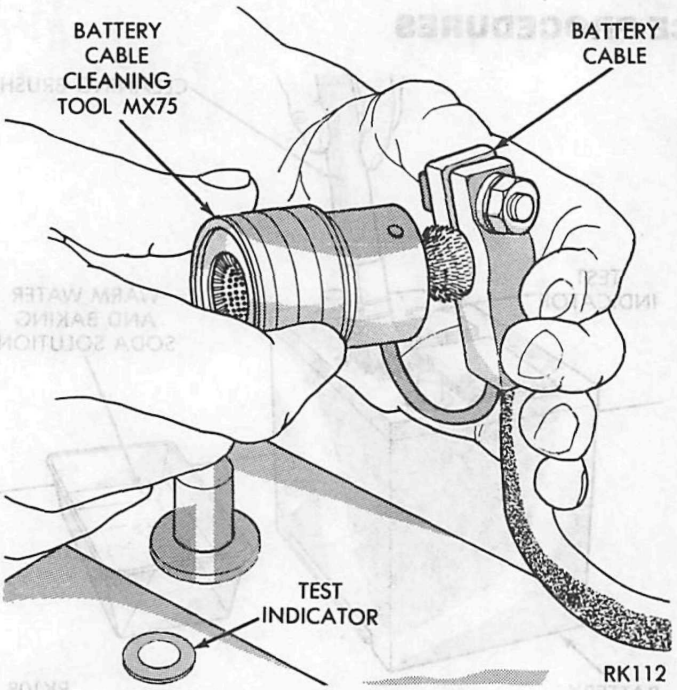


Fig. 4—Clean Clamps

INSTALLATION

(1) Position the battery in the tray. Ensure that the positive and negative terminals (posts) are correctly located. The cables must reach their respective posts without stretching.

(2) Ensure that the tab at the battery base is positioned in the tray properly before tightening the holddown.

(3) Install the battery holddown and secure with the holddown nut.

CAUTION: It is important that the cables are connected to the battery positive cable to positive terminal and negative cable to negative terminal. Reverse polarity will damage the alternator diodes and radio(s).

(4) Place felt grease washer onto positive (+) battery post.

(5) Connect and tighten the positive cable terminal clamp first to torque specified.

(6) Connect and tighten the negative cable terminal clamp to torque specified.

(7) Test battery cable resistance, see Group 8B, Starting System.

BATTERY SPECIFICATIONS

Load Test (Amps)	Cold Cranking Rating @ 0°F	Reserve Capacity
250 Amp	500 Amp	110 Minutes

CRANKING RATING is the current a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at specified temperature.

RESERVE CAPACITY RATING is the length of time a battery can deliver 25 amps and maintain a minimum terminal voltage of 10.5 volts at 27°C (80°F).

STARTING SYSTEM

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STARTER TEST PROCEDURES

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GENERAL INFORMATION

The starting system on Chrysler Motors vehicles consist of an ignition switch, starter relay, neutral safety switch (automatic transmission), wiring harness, battery, and starter motor with an integral solenoid. These components form 2 separate circuits. A high amperage circuit that feeds the starter motor up to 300+ amps, and a control circuit that operates on less than 20 amps (Fig. 1).

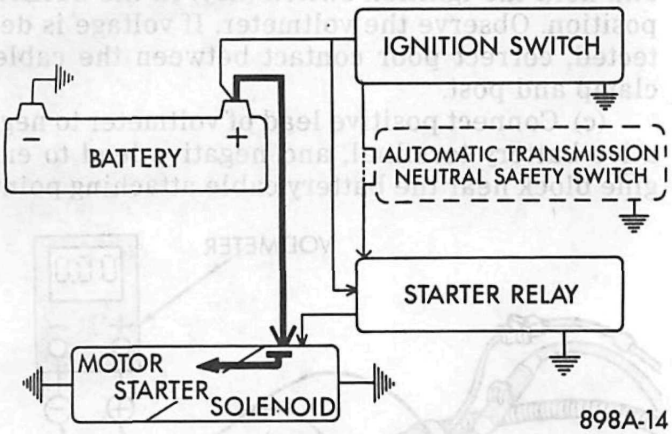


Fig. 1—Starting System Components

DIAGNOSTIC PREPARATION

Before proceding with starting system diagnostics, verify the following conditions:

(1) Battery top, posts, and terminals are clean.
(2) Alternator drive belt tension and condition.
(3) Battery state-of-charge.
(4) Battery will endure load test.
(5) Battery cable (+/–) connections at the starter motor and engine block and their condition.
(6) Wiring harness connector and terminal condition.
(7) Properly grounded.

STARTER FEED CIRCUIT TESTS

The following procedure will require a suitable volt-ampere tester (Fig. 2) and a jumper wire.

(1) Connect a suitable volt-ampere tester (Fig. 2) to the battery terminals (Fig. 3), refer to the operating instructions provided with the tester being used.

(2) Disconnect the ignition coil cable from the distributor cap and connect a suitable jumper

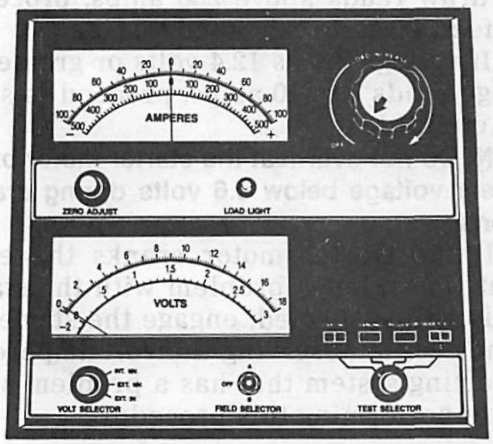


Fig. 2—Volt Ampere Tester (Typical)

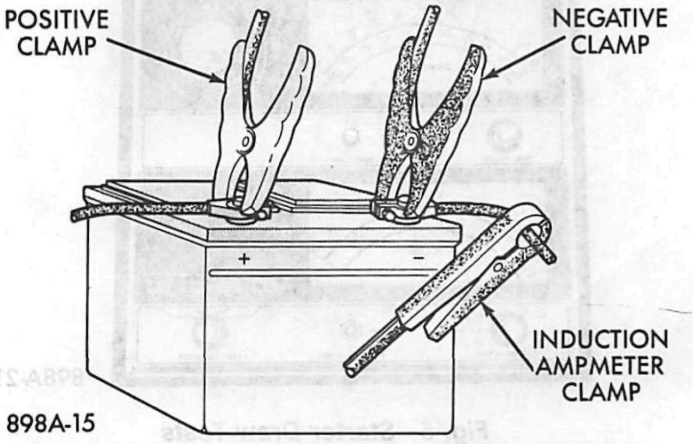


Fig. 3—Volt-Ampere Tester Connections (Typical)

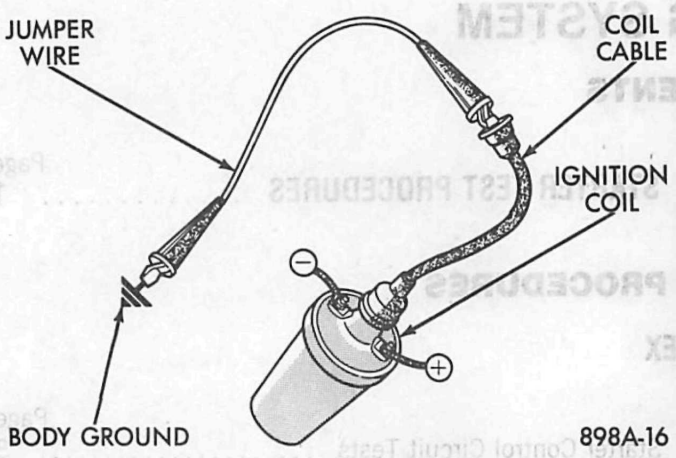


Fig. 4—Ground Ignition Coil Cable

wire between the coil cable end-terminal and a good body ground (Fig. 4).

(3) Verify that all lights and accessories are OFF and the transmission shift selector is in PARK (automatic) or NEUTRAL (manual) and set parking brake or equivalent.

(4) Rotate and hold the ignition switch (key) in the START position. Observe the volt-ampere tester (Fig. 5).

(a) If voltage reads above 9.6 volts and amperage draw reads above 250 amps, proceed to starter feed circuit resistance test.

(b) If voltage reads 12.4 volts or greater and amperage reads 0 to 10 amps, proceed to starter control circuit test.

CAUTION: Do not overheat the starter motor or draw the battery voltage below 9.6 volts during cranking operations.

(c) If the starter motor cranks the engine freely at times, but a problem with the starting system is still suspected, engage the starter several times while observing the volt-ampere tester. A starting system that has a problem should fail while performing this procedure.

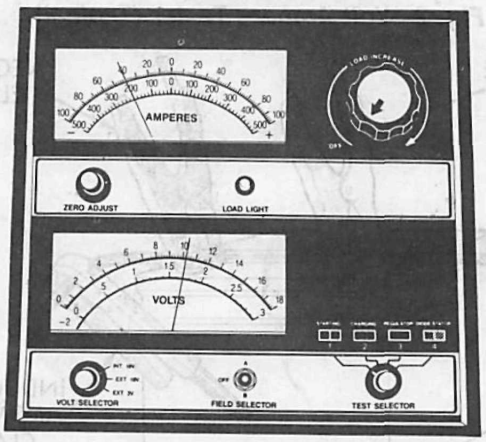


Fig. 5—Starter Draw Tests

(5) After starting system problems have been corrected, verify the battery state-of-charge (charge battery if necessary). Disconnect all testing equipment and jumper wires and connect coil cable. Start the vehicle several times to assure the problem has been corrected.

Starter Feed Circuit Resistance Test

Before proceding with this operation, review Diagnostic Preparation and Starter Feed Circuit Tests. The following operation will require a voltmeter, accurate to 1/10 of a volt.

(1) Disconnect the ignition coil cable from the distributor cap and connect a suitable jumper wire between the coil cable end-terminal and a good body ground (Fig. 4).

(2) With all wiring harness and components connected properly, perform the following:

(a) Connect positive lead of the voltmeter to the negative battery post, and negative lead to the negative battery cable clamp (Fig. 6). Rotate and hold the ignition switch key in the START position. Observe the voltmeter. If voltage is detected, correct poor contact between cable clamp and post.

(b) Connect positive lead of the voltmeter to the positive battery post, and negative lead to the positive battery cable clamp (Fig. 6). Rotate and hold the ignition switch (key) in the START position. Observe the voltmeter. If voltage is detected, correct poor contact between the cable clamp and post.

(c) Connect positive lead of voltmeter to negative battery terminal, and negative lead to engine block near the battery cable attaching point

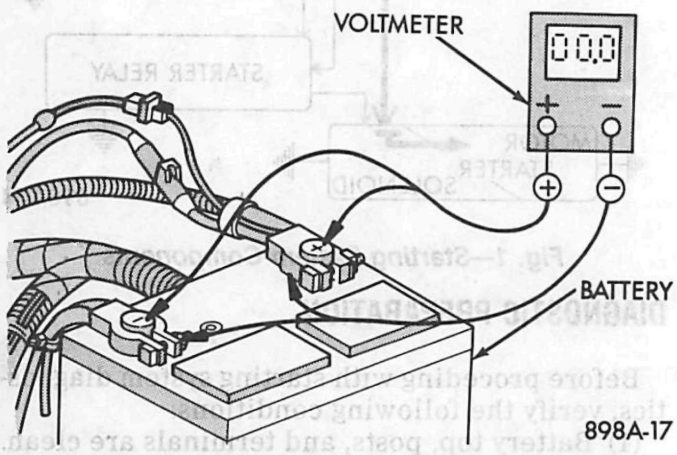


Fig. 6—Test Battery Connection Resistance

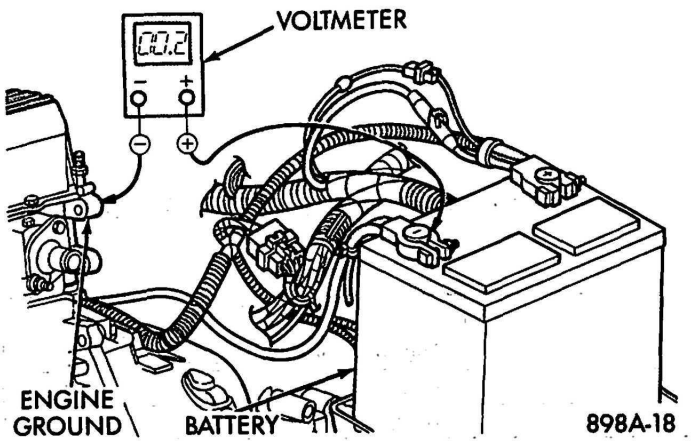


Fig. 7—Test Ground Circuit Resistance

(Fig. 7). Rotate and hold the ignition switch (key) in the START position. If voltage reads above 0.2 volt, correct poor contact at ground cable attaching point. Voltage reading still above 0.2 volt, replace ground cable.

(3) Remove starter heat shield (if equipped) to gain access to the starter motor and solenoid connections, perform the following:

(a) Connect positive voltmeter lead to the starter motor housing and the negative lead to the negative battery terminal (Fig. 8). Rotate and hold the ignition switch (key) in the START position. If voltage reads above 0.2 volt, correct poor starter to engine ground.

(b) Connect positive voltmeter lead to positive battery terminal and negative lead to battery cable terminal on starter solenoid (Fig. 9). Rotate and hold the ignition switch (key) in the START position. If voltage reads above 0.2 volt, correct poor contact at battery cable to solenoid connection. If reading is still above 0.2 volt, replace positive battery cable.

If resistance tests detect no feed circuit failures, remove the starter motor and proceed to Bench Testing Starter Solenoid.

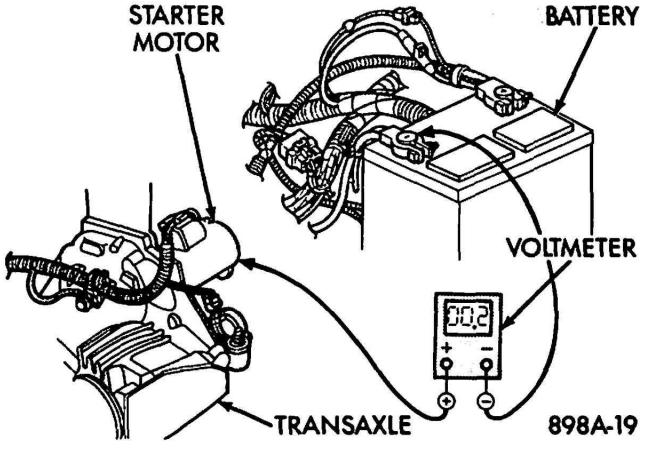


Fig. 8—Test Starter Motor Ground (Typical)

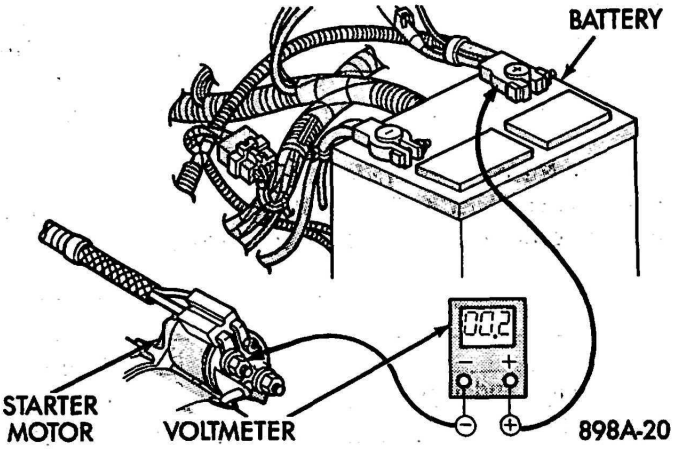


Fig. 9—Test Positive Battery Cable Resistance (Typical)

STARTER CONTROL CIRCUIT TESTS

Starter control circuit consists of starter solenoid, starter relay, ignition switch, safety neutral switch (automatic transmission), and all their wiring and connections.

Testing procedures for these components are as follows and should be followed in order as described.

CAUTION: Before performing any test disconnect coil wire from distributor cap center tower and secure to a good ground to prevent engine from starting (Fig. 4).

Starter Solenoid Test

Connect a heavy jumper wire on starter relay between battery (1) and solenoid (3) terminals (Fig. 10). If engine cranks starter solenoid is good. Proceed to starter relay test.

If engine does not crank or solenoid chatters check wiring and connectors from relay to starter

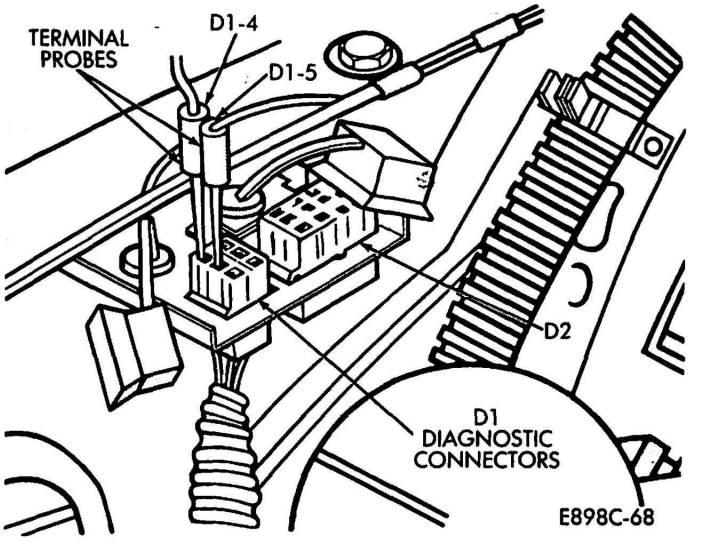


Fig. 10—Starter Solenoid Test

for loose or corroded connections, particularly at starter terminals. Repeat test and if engine still fails to crank properly trouble is within starter and it must be removed for repairs.

Starter Relay Test (Fig. 11)

WARNING: CHECK TO ENSURE THAT THE TRANSMISSION IS IN PARK WITH THE PARKING BRAKE APPLIED: Ignition Switch in START Position.

TEST	OK	NOT OK
Terminal 2	Battery voltage	Repair open from ignition switch
Terminal 1 and Terminal 5	0 volts	Repair ground path
Terminal 4	Battery voltage	Repair start relay

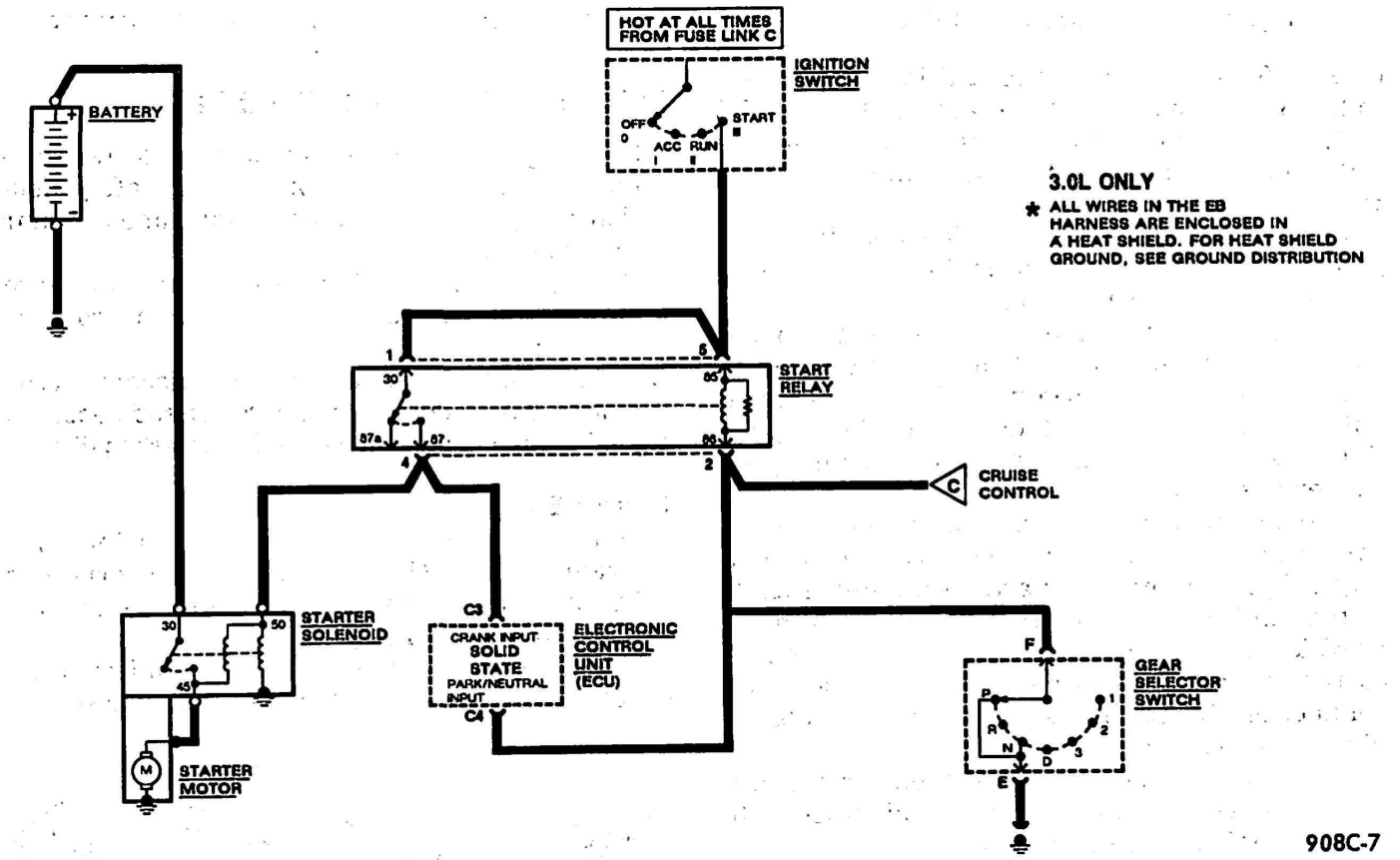


Fig. 11—Starter System Schematic

Ignition Switch Test

After testing starter solenoid and relay and they check out okay, trouble is probably with ignition switch or its wiring.

Check all wiring for opens and shorts and connections for being loose or corroded.

Bench Testing Starter Solenoid

(1) Disconnect field coil wire from field coil terminal (Fig. 12).

(2) Check for continuity between solenoid terminal and field coil terminal with a continuity tester. There should be continuity (Fig. 13).

(3) Check for continuity between solenoid terminal and solenoid housing. There should be continuity (Fig. 14).

(4) If there is continuity solenoid is good. If there is no continuity in either test solenoid has an open circuit and is defective. Replace solenoid assembly.

(5) Connect field coil wire to field coil terminal (Fig. 12).

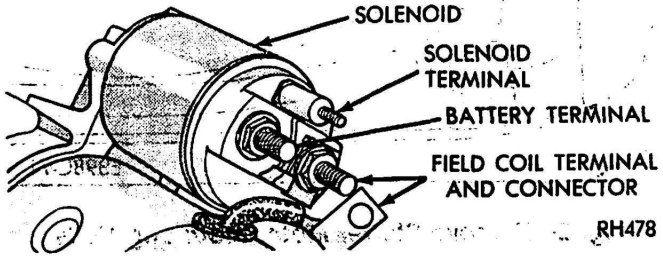


Fig. 12—Field Coil Wire Terminal

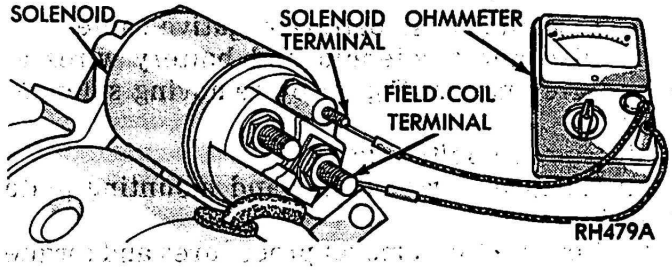


Fig. 13—Continuity Test Between Solenoid Terminal and Field Coil Terminal

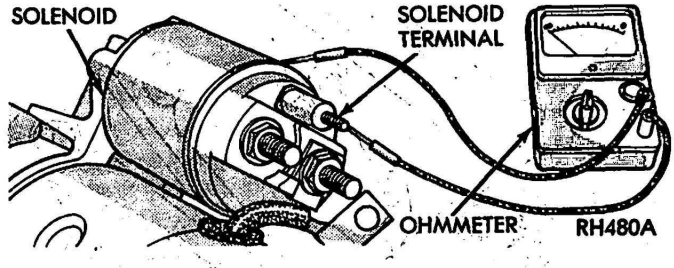


Fig. 14—Continuity Test Between Solenoid Terminal and Solenoid Case

STARTER SERVICE PROCEDURES

STARTER REMOVAL/INSTALLATION

(1) Disconnect the battery negative cable.
(2) Disconnect solenoid and battery wires at the starter motor (Fig. 1) by removing solenoid nuts.
(3) Remove bolts (Fig. 2).
(4) Remove starter motor and mounting plate (Fig. 3).
(5) Reverse the removal procedures and torque the mounting hardware.

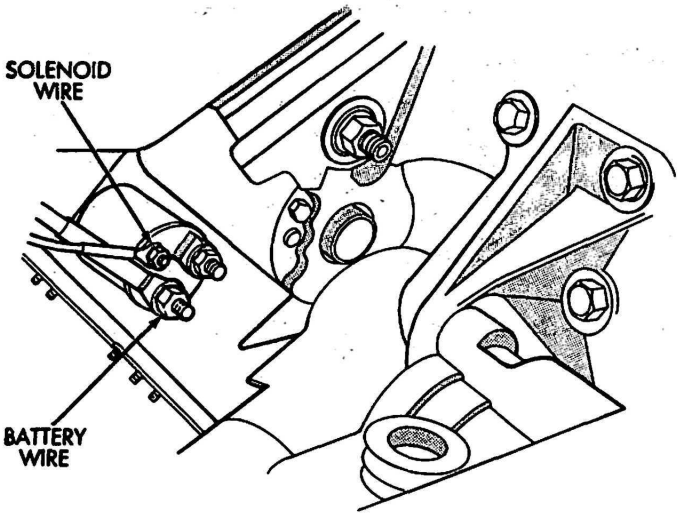


Fig. 1—Disconnect Solenoid Wires

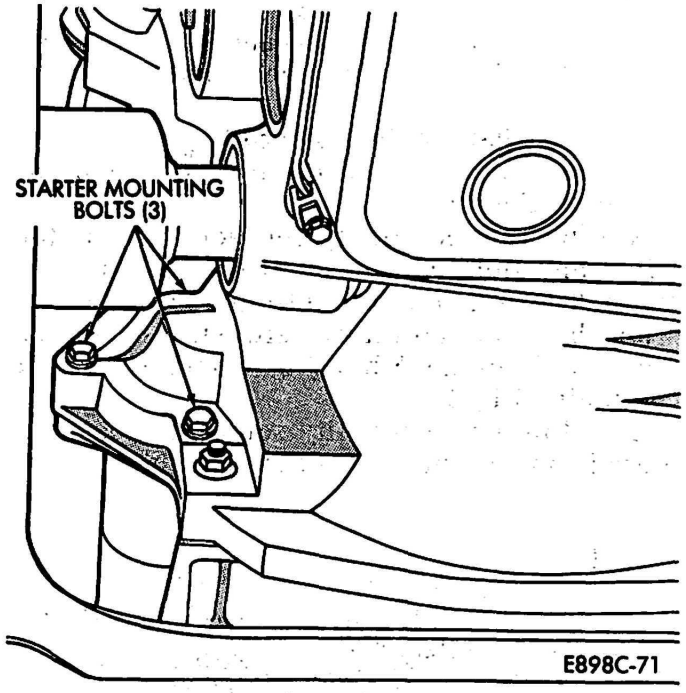


Fig. 2—Remove Starter Motor Mounting Bolts

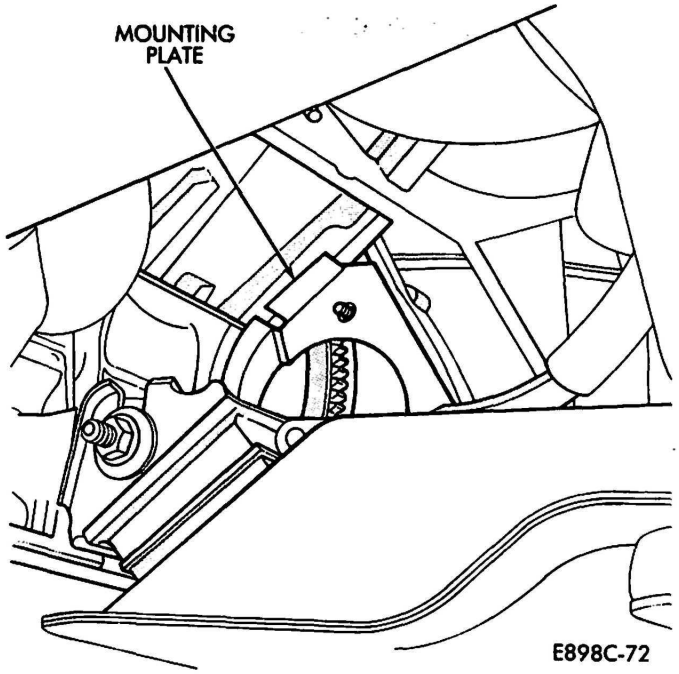


Fig. 3—Remove Mounting Plate

SPECIFICATIONS

Torque

Components	Service Set-To Torque
Starter Motor	
Mounting Bolts	21 N·m (20 ft-lbs)
Starter Solenoid B+ Nut ...	9 N·m (80 in-lbs)
Solenoid Wire to Starter ...	? N·m (?? in-lbs)

Cold Cranking

Battery Test Voltage	12.5 Volts
Cold Cranking Voltage (Min.)	9.6 Volts
Cold Cranking Amps	130 Amps

Starter Motor

Component	Specifications
Carbon Brushes	Minimum Length-9 mm (0.354 in.)
Ring/Pinion Clearance	2-5 mm (0.078-0.196 in.)
Back lash (Meshed Ring & Pinion)	0.3-0.7 mm (0.012-0.028 in.)
Commutator Diameter	28.4 mm (1.118 in.)-29.5 (1.161 in.)
Run Out	
Commutator	0.03 mm (0.001 in.)
Armature (Core)	0.08 mm (0.003 in.)
Armature End Play	0.58 mm (0.023 in.)
No Load Test With 11.2 volts	
Max. Amps	80
Min. RPM	2500
Solenoid Hold-in Winding Voltage	3.5 Min.
Pull-in Winding Voltage	7.8 Max.

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CHARGING SYSTEM

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GENERAL INFORMATION

The Premier is equipped with a Delco CS-130 alternator. The alternator does not use a diode trio. The regulator will cause the charge indicator lamp to be on with the engine running if the system voltage is too high or too low.

The alternator has sealed bearings with lifetime lubrication in both end frames. A conventional fan mounted next to the pulley pulls air through the assembly for cooling. An internal fan mounted on the rotor pulls air through the slip ring end frame to cool the rectifier bridge and regulator. The air is expelled through openings in the end frame. No periodic maintenance on the alternator is required.

The alternator supplies DC voltage to recharge the battery and operate the vehicle's electrical system. A built-in solid-state voltage regulator controls the output of the alternator. When output voltage is low or high the solid-state regulator will control field current for proper voltage.

When operating normally, the charge indicator lamp will come on when the ignition switch is turned to RUN or START, and will then go out when the engine starts. With the engine running the charge indicator lamp should come on only when there is a problem in the charging system.

If the indicator operates abnormally, or if an undercharged or overcharged battery condition occurs, refer to Diagnostic Procedures in this section.

DIAGNOSTIC PROCEDURES

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SYMPTOMS

The following symptoms are indications that the charging system may not be operating properly:

- Alternator indicator lamp does not go out after engine starts.
- Alternator indicator lamp goes out after start-up, but engine cranking is continuously slow.
- Alternator output voltage is over 15 volts. High output reduces bulb life.
- Alternator noise
  - —loose mounting bolts
  - —loose or misaligned pulley
  - —worn slip rings and brushes
  - —shorted rectifier diode(s)

Battery/Cables/Drive Belt

TEST	OK	NOT OK
Inspect condition of battery cable terminals	Clean and tight	Repair as required
Battery state of charge. Refer to Group 8A, Battery	Battery passes test	See Group 8A, Battery
Inspect drive belt condition and tension	Drive belt serviceable	Adjust or replace belt as required
Inspect connection at alternator B+ output	Clean and tight	Repair as required

Alternator Connections: Ignition ON; Alternator Connector Separated From Alternator

TEST	OK	NOT OK
Jumper wiring harness terminal L to ground	Battery indicator lamp lights	Check Fuse. Check bulb. If bulb is good, repair open to Fuse 15
Wiring harness Terminal F (1)	Battery voltage	Repair open from ignition switch
Alternator housing to clean chassis ground	Zero ohms	Clean ground connections and braided ground strap
Wiring harness Terminal B+	Battery voltage	Repair open from battery with negative battery cable disconnected

Ignition Off Draw Through Alternator

TEST	OK	NOT OK
See Group 8A, Battery	No current leakage	Replace alternator if cause of draw.

Alternator Output

TEST	OK	NOT OK
Refer to Alternator Output Test	Output as specified	Replace alternator

OUTPUT TEST

The following instructions refer to the S-VAT-40, volts-amps-tester (Fig. 1). Refer to the manufacturer's instructions if using another meter.

Battery must first pass load and voltage drop tests. Refer to Group 8A.

(1) Turn carbon pile knob to OFF.
(2) Turn volt selector knob to EXT 0-18-VDC.
(3) Clamp on positive load lead.
(4) Clamp on negative load lead.
(5) Clamp on amp probe with arrow pointing in direction B (Fig. 1).
(6) Adjust amperes meter reading to 0 by turning zero adjusting knob.
(7) Fully engage parking brake. Place manual transmission in NEUTRAL.
(8) Start engine.

Allow 15 minutes for warm-up and a minimum outout of 13.0 volts before testing current output.

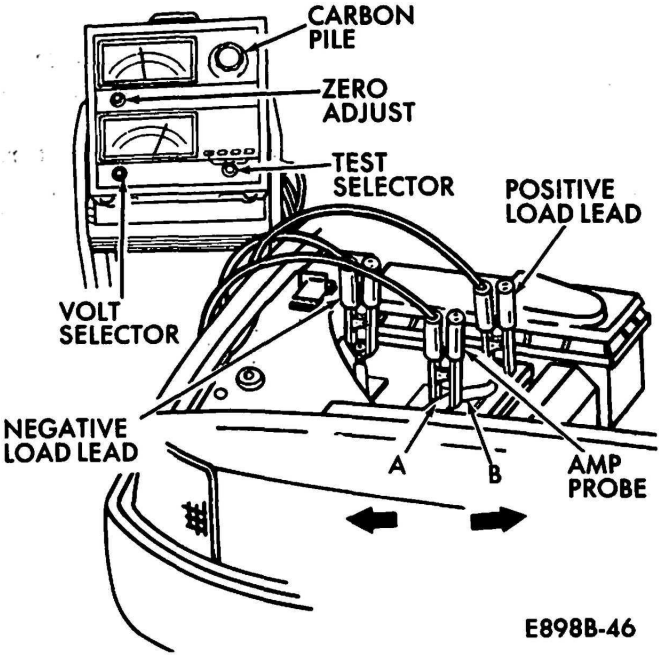


Fig. 1—Alternator Output Test Hookup

(9) Refer to Alternator Specifications.
(a) Set engine rpm.
(b) Turn carbon pile to match alternator output.
(c) Battery voltage should not drop below 13.0 volts.
(d) If alternator output is not to specifications, replace Alternator.

ALTERNATOR SERVICE

V6-ENGINE

Removal

(1) Disconnect the battery negative cable.
(2) Raise and support the vehicle.
(3) Remove lower splash shield.
(4) Disconnect electrical connector (Fig. 1).
(5) Relieve tension on drive belt by turning adjusting bolt.
(6) Loosen and remove mounting bolt and pivot bolt.
(7) Remove drive belt.
(8) Remove alternator.

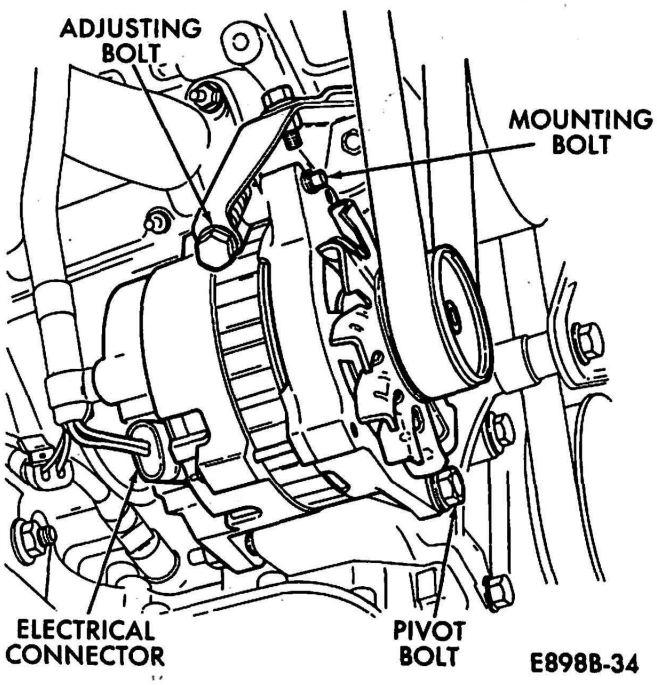


Fig. 2—Alternator Removal

Installation

(1) Position alternator and install mounting bolt and pivot bolt. Do not tighten the bolts at this time.
(2) Install drive belt over pulley (Fig. 3).
(3) Torque alternator pivot bolt to 50 N·m (37 ft-lbs).
(4) Install belt tension gauge in the middle of a belt span. Ensure that the tension gauge is not touching any engine component.
(5) Tighten adjusting bolt until the correct belt tension is obtained:
New Belt 800-900 N (180-200 lbs), Used Belt 623-712 N (140-160 lbs).
(6) Torque mounting bolt to 27 N·m (20 ft lbs).
(7) Recheck torque on pivot bolt.
(8) Install splash shield.
(9) Lower vehicle.
(10) Connect the battery negative cable.

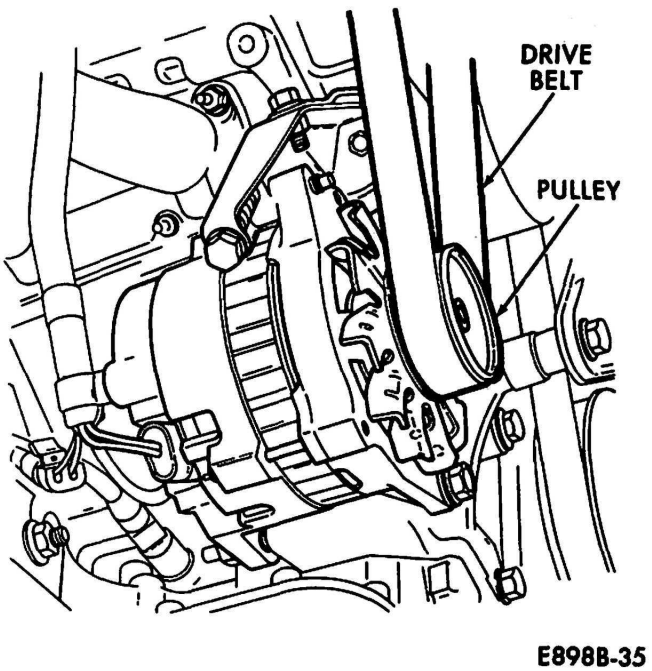


Fig. 3—Alternator Installation

SPECIFICATIONS

CURRENT OUTPUT

Engine RPM	Alternator RPM	Delco CS130-85 Amp	Delco CS130-96 Amp	Delco CS130-105 Amp
800	2250	48A	51A	60A
1200	3350	61A	65A	74A
2000	5600	70A	78A	84A

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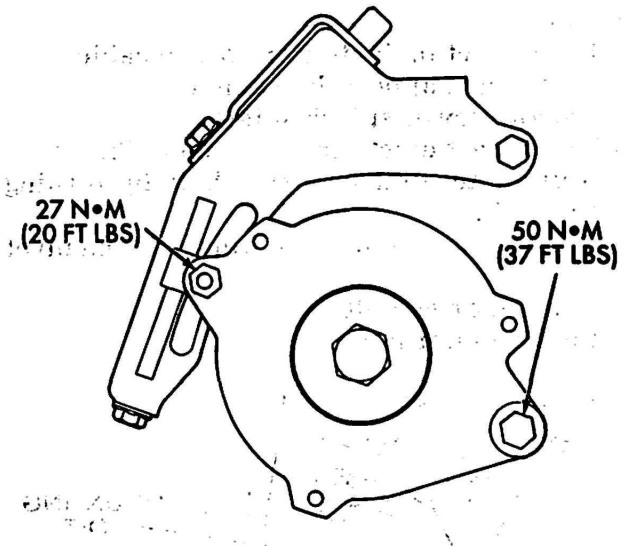
ALTERNATOR

- Frame Diameter: 130 mm (5.12 in)
- Weight: 4.6Kg (9.92 lbs.)
- Maximum Speed: 15,000 rpm Continuous
- 18,000 rpm Intermittent
- Polarity: Negative
- Rotation: Clockwise



ALTERNATOR TORQUE

V-6



E898B-41

IGNITION SYSTEM

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3.0L SIX CYLINDER

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GENERAL INFORMATION

The ignition system used on the 3.0L engine consists of:

- A solid-state ignition control module to generate the voltage for spark plug firing.
- An electronic control unit (ECU) to process input information to fire the ignition control module.

Ignition timing (advance/retard is controlled by the ECU and is not adjustable.)

- A speed sensor with flywheel trigger to input crankshaft position for the ECU.

IGNITION CONTROL MODULE (ICM)

The ignition control module is mounted to the ignition coil (Fig. 1). Based on control system inputs, the ECU triggers the ignition coil via the ignition control module. The ECU is able to advance or retard ignition timing by controlling the ignition coil through the ignition control module.

The ICM consists of a solid-state ignition circuit and an integrated ignition circuit and an integrated ignition coil that can be removed and serviced separately if necessary.

The ECU provides an input signal to the ICM. The ICM has only two outputs:

- Tach signal to the tachometer and diagnostic connector
- High voltage from the coil to the distributor cap.

ICM CONNECTIONS

Electrical feed to the ICM is through terminal A of Connector No. 1 on the module (Fig. 2).

Electrical supply only occurs with the ignition switch in the START and RUN positions.

Terminal B of Connector No. 1 is grounded at the engine oil dipstick bracket along with the ECU ground wire and oxygen (O_2) sensor ground.

The tachometer output signal wire of the ICM is connected to Pin No. 1 of the D1 diagnostic connector. The wire is routed to the diagnostic connector through a short section of the ECU harness, the engine and instrument panel harness. This type of routing eliminates any potential electrical interference in the various ECU circuitry.

Ignition firing signal from ECU terminal 27 are transmitted through terminal B of Connector No. 2 on the ICM. The ignition signal from the ECU is received by the ICM in the form of a 5

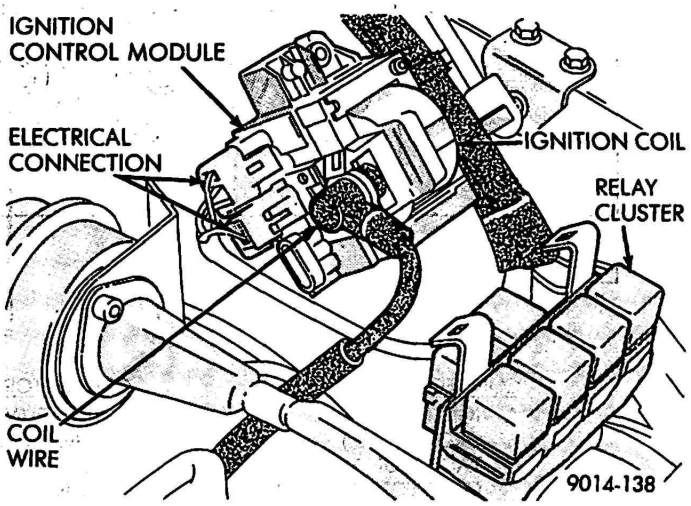


Fig. 1—Ignition Control Module

volt square wave. As the leading edge of the wave contacts the ignition circuitry in the ICM, the ICM charges the coil primary windings.

When coil saturation occurs, the module circuitry opens the primary windings to collapse the magnetic field in the windings. This induces the high voltage in the coil secondary windings which is then transmitted to the spark plugs via the coil wire, distributor cap, and rotor.

ECU INPUTS

Manifold Absolute Pressure (MAP) Sensor

The MAP sensor reacts to absolute pressure in the intake manifold and provides an input voltage to the ECU. As engine load changes manifold pressure varies, causing the MAP sensors resistance to change. The change in MAP sensor resistance results in a different input voltage to the ECU. The input voltage level supplies the ECU with information relating to ambient barometric pressure during engine start-up (cranking) and to engine load while the engine is running. The ECU uses this information to adjust the air-fuel mixture accordingly.

The MAP sensor is mounted in the engine compartment on the dash panel and is connected to the throttle body with a vacuum hose (Fig. 3).

Coolant Temperature Sensor

The coolant temperature sensor is installed in the thermostat housing (Fig. 4). It provides an input voltage to the ECU. As coolant temperature varies the Coolant Temperature Sensor resistance changes resulting in a different input voltage to the ECU. Based on this input the ECU will:

- Adjust fuel injector pulse width. Colder coolant temperatures will result in longer injector pulse width and richer air-fuel mixtures.
- Compensate for fuel condensation in the intake manifold.
- Control engine warm-up idle speed.
- Increase ignition advance when the coolant is cold.
- Energize the EGR valve solenoid thus preventing the flow of vacuum to the EGR valve.

Manifold Air Temperature (MAT) Sensor

The Manifold Air Temperature (MAT) sensor is installed in the throttle body adapter at the rear of the intake manifold with sensor element extending into the air stream (Fig. 5). The MAT sensor provides an input voltage to the ECU. As the temperature of the air stream in the manifold varies, the MAT sensor resistance changes resulting in a different input voltage to the ECU.

Speed Sensor (Crankshaft Position Sensor—CPS)

The speed sensor, attached to the torque converter drive plate housing, provides an input signal to the ECU relating to crankshaft angle (position) (Fig. 6). The ECU converts the rate of change of crankshaft angle into engine RPM and the crankshaft angle to piston position. The speed sensor senses TDC, BDC and engine speed by detecting the flywheel teeth as they pass during

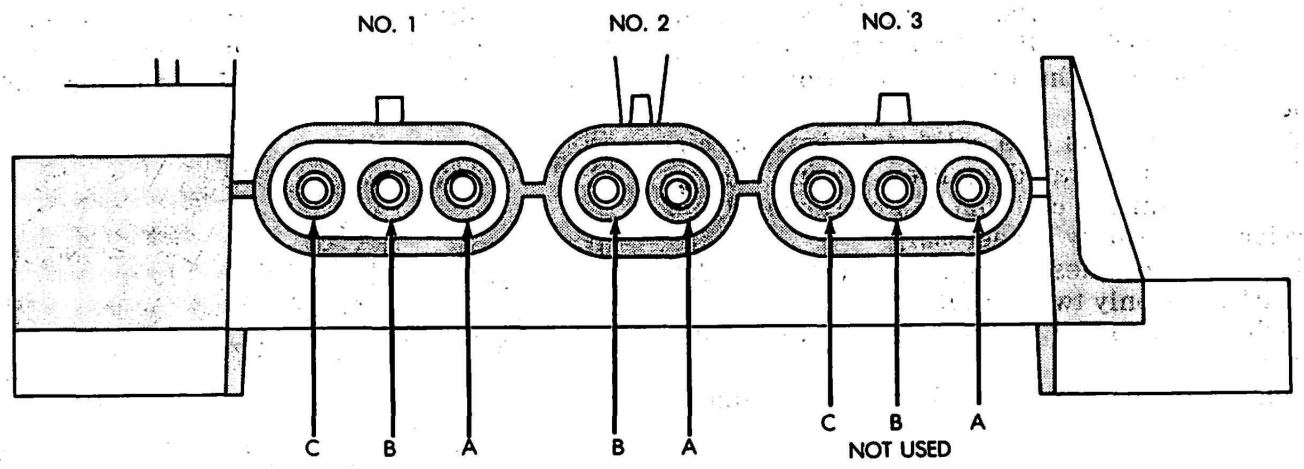


Fig. 2—ICM Connections

engine operation. The speed sensor is non-adjustable.

The drive plate pulse ring has three trigger notches, 120° apart. There are 20 small teeth (windows) between each trigger notch. Each large trigger notch is located 12 small teeth before each Top Dead Center (TDC) position of the corresponding pistons (Fig. 7).

When a tooth and notch pass the magnet core of the speed sensor, a voltage spike is induced in the sensor pick-up coil winding (Fig. 8). The voltage spikes allow the ECU to count the teeth as they pass the sensor. When a trigger notch passes the speed sensor there is a longer than usual delay between voltage spikes. This longer delay tells the ECU that a piston will be at the TDC position 12 voltage spikes later. The ECU uses information from the speed sensor to control spark timing and fuel injection timing for each cylinder.

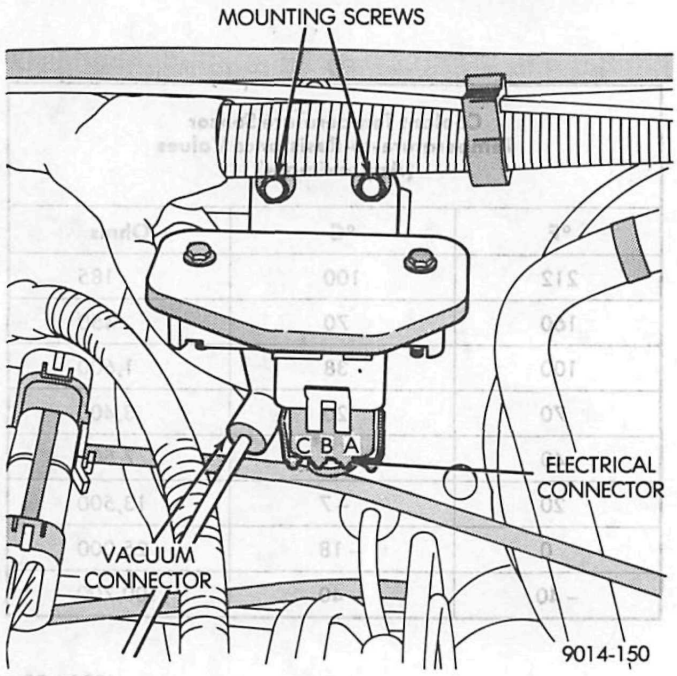


Fig. 3—MAP Sensor

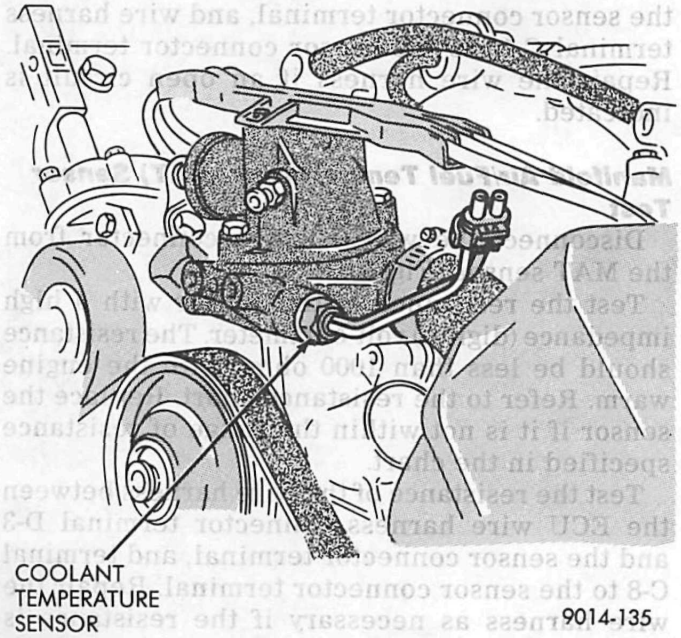


Fig. 4—Coolant Temperature Sensor

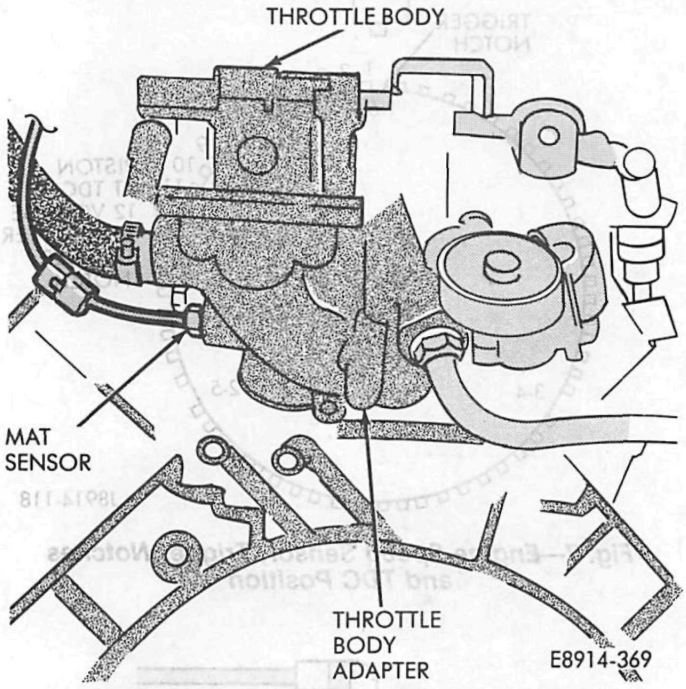


Fig. 5—Manifold Air Temperature Sensor

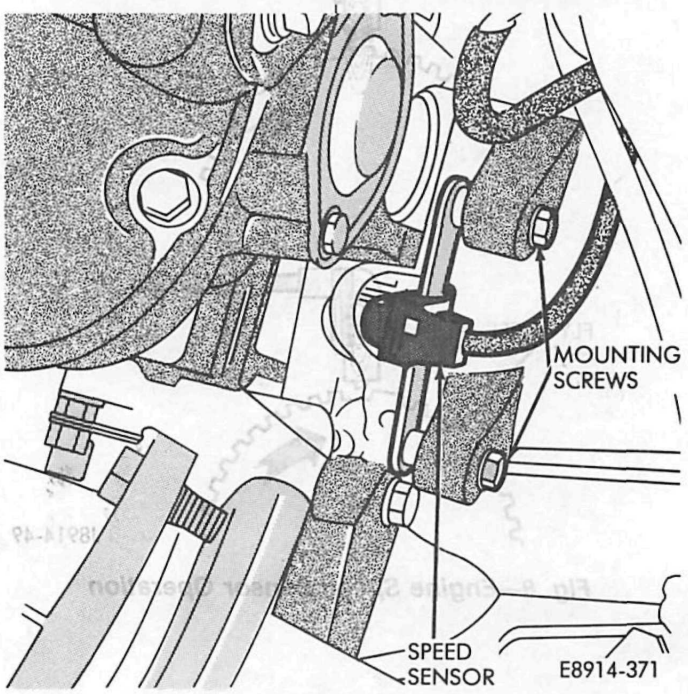


Fig. 6—Engine Speed Sensor

The longer voltage spike indicates to the ECU that a piston will soon be at the TDC position, 12 teeth later. The ignition timing for the particular cylinder is either advanced or retarded as necessary by the ECU according to sensor inputs.

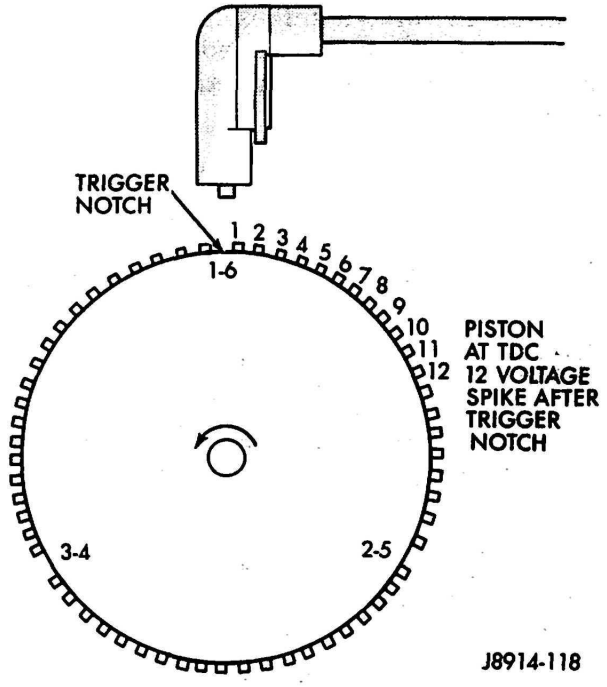


Fig. 7—Engine Speed Sensor, Trigger Notches and TDC Position

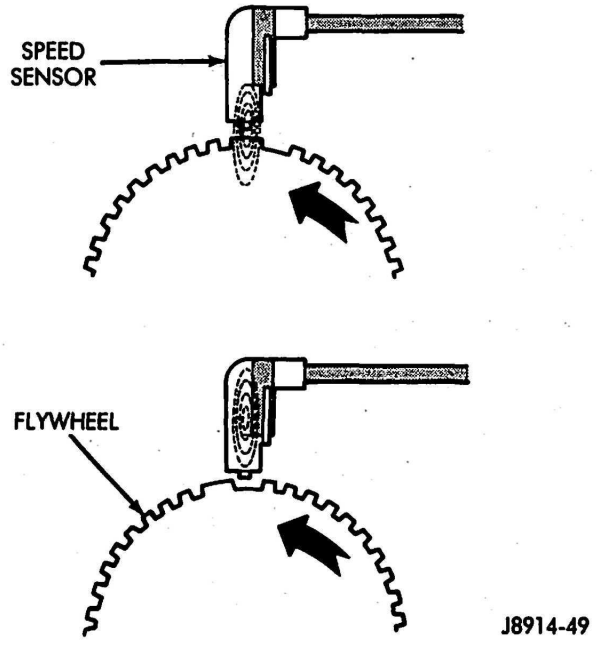


Fig. 8—Engine Speed Sensor Operation

COMPONENT DIAGNOSTIC PROCEDURES

Coolant Temperature Sensor Test

Disconnect wire harness connector from coolant temperature sensor (Fig. 4).

Test the resistance of the sensor with a high input impedance (digital) volt-ohmmeter. The resistance should be less than 1000 ohms with the engine warm. Refer to the resistance chart. Replace the sensor if it is not within the range of resistance specified in the chart.

Coolant Temperature Sensor Temperature-to-Resistance Values (Approximate)

°F	°C	Ohms
212	100	185
160	70	450
100	38	1,600
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

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Test the resistance of the wire harness between ECU wire harness connector terminal D-3 and the sensor connector terminal, and wire harness terminal C-10 to the sensor connector terminal. Repair the wire harness if an open circuit is indicated.

Manifold Air/Fuel Temperature (MAT) Sensor Test

Disconnect the wire harness connector from the MAT sensor (Fig. 9).

Test the resistance of the sensor with a high impedance (digital) volt-ohmmeter. The resistance should be less than 1000 ohms with the engine warm. Refer to the resistance chart. Replace the sensor if it is not within the range of resistance specified in the chart.

Test the resistance of the wire harness between the ECU wire harness connector terminal D-3 and the sensor connector terminal, and terminal C-8 to the sensor connector terminal. Repair the wire harness as necessary if the resistance is greater than 1 ohm.

Manifold Absolute Pressure (MAP) Sensor Test

Inspect the MAP sensor vacuum hose connections at the throttle body and sensor. Repair as necessary.

Manifold Air/Fuel Temperature Sensor Temperature-to-Resistance Values (Approximate)

°F	°C	Ohms
212	100	185
160	70	450
100	38	1,600
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

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CAUTION: When testing the MAP sensor, insert the tester leads through the back of the connector, ensure that the harness wires are not damaged by the test meter leads.

Test the MAP sensor output voltage at the MAP sensor connector terminal B (as marked on the sensor body) with the ignition switch ON and the engine OFF (Fig. 10). Output voltage should be 4-5 volts. Start the engine and allow idle to stabilize. Recheck output voltage at terminal B. The voltage should drop to 1.5-2.1 volts with a hot, neutral idle speed condition.

Test ECU terminal C-6 for the same voltage described above to verify the wire harness condition. Repair as necessary.

Test MAP sensor supply voltage at sensor connector terminal C with the ignition ON. The voltage should be 5 volts (±0.5V). Five volts (±0.5V) should also be at terminal C-14 of the ECU wire harness connector. Repair or replace the wire harness as necessary.

Test the MAP sensor ground circuit at sensor connector terminal A and ECU connector terminal D-3. Repair the wire harness if necessary.

Speed Sensor (Crankshaft Position Sensor—CPS) Test

Disconnect the speed sensor connector from the harness (Fig. 11).

Place an ohmmeter across terminals A and B (marked on connector). The meter reading should be 200 ± 75 ohms (hot engine). Replace sensor if readings are not to specifications.

Spark Plugs

Faulty or fouled plugs may perform well at idle speed, but at higher engine speeds they frequently fail. Faulty plugs can be identified in a number of ways: poor fuel economy, power loss,

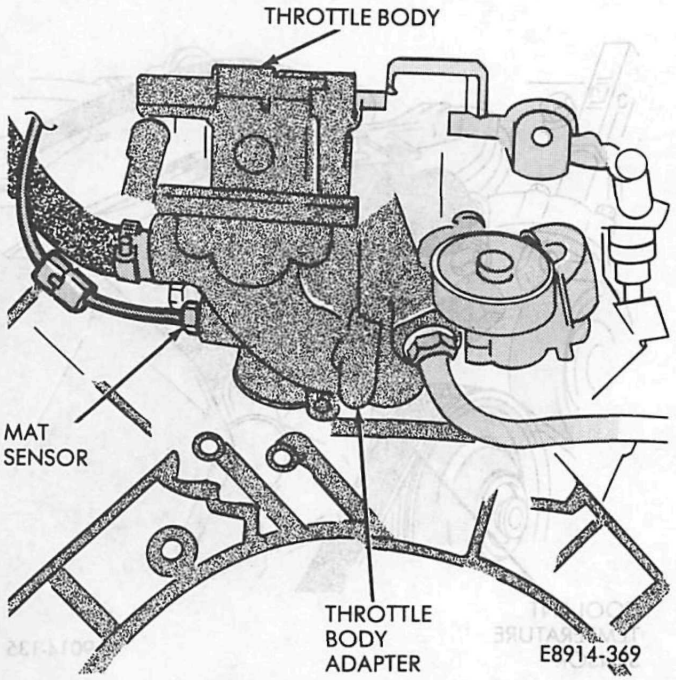
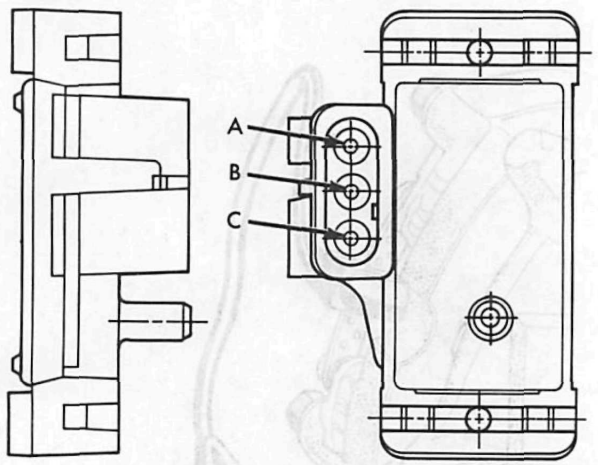


Fig. 9—Manifold Air Temperature Sensor



A. Ground
B. Output Voltage
C. 5 Volts

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Fig. 10—MAP Sensor Connector Terminals

decrease in engine speed, hard starting and, in general, poor engine performance.

Spark plugs also malfunction because of carbon fouling, excessive electrode air gap, or a broken insulator.

SERVICE PROCEDURES

Ignition Control Module (ICM)

Removal

(1) Disconnect ICM electrical connectors (Fig. 14).
(2) Remove high tension wire.
(3) Remove nuts.
(4) Remove ICM.

Installation

(1) Position ICM and install nuts.
(2) Snap electrical connectors into place on the ICM.
(3) Snap high tension wire onto ICM.

Coolant Temperature Sensor

Removal

The coolant temperature sensor is located in the thermostat housing, above the water pump (Fig. 13).

CAUTION: It is essential that coolant does not contact the accessory drive belt or pulleys because it may cause the belt to slip and/or squeak. Cover the belt and pulleys with shop towels to protect them from coolant spillage. If coolant contacts the belt or pulleys, flush them with clean water.

(1) Disconnect electrical connector.
(2) Remove coolant temperature sensor and immediately plug the opening in the water pump (Fig. 13).

Installation

(1) Screw coolant temperature sensor into the thermostat housing.
(2) Tighten the sensor to 28 N·m (21 ft-lbs) torque.

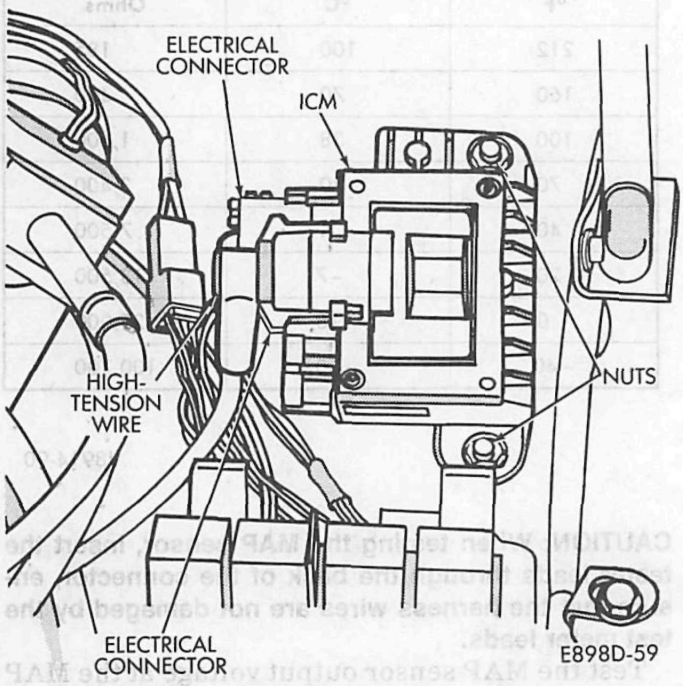


Fig. 12—ICM Removal/Installation

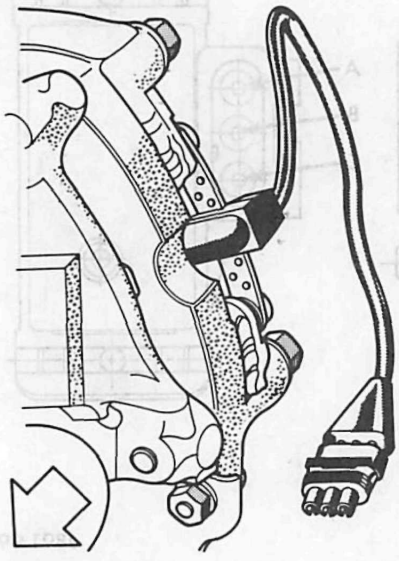


Fig. 11—Engine Speed Sensor

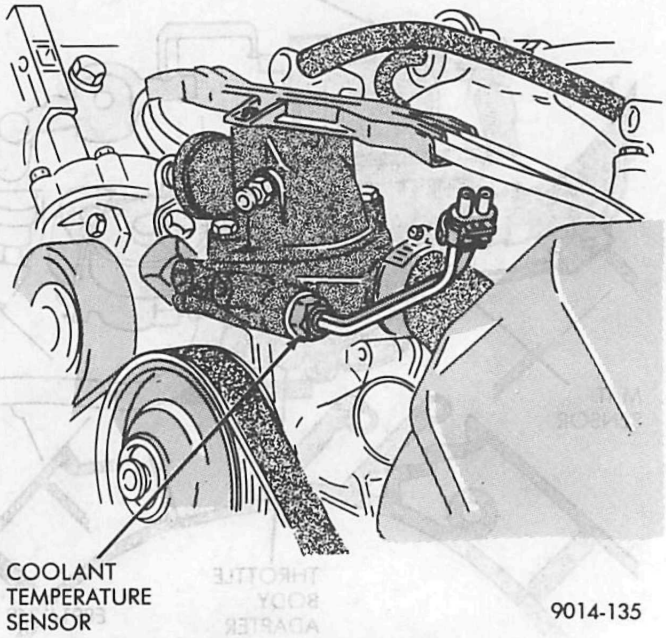


Fig. 13—Coolant Temperature Sensor Removal/Installation

(3) Connect electrical connector to sensor.
(4) Remove the shop towels from the accessory drive belt and pulleys.

Manifold Air Temperature Sensor

Manifold Air Temperature (MAT) sensor is located in the throttle body adaptor below the throttle body and behind the fitting for the Brake Vacuum Booster (Fig. 14).

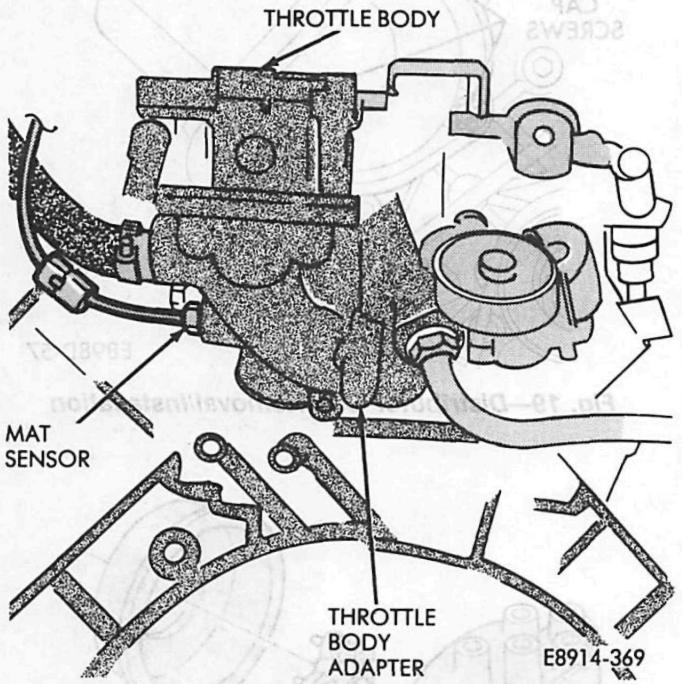


Fig. 14—MAT Sensor Removal/Installation

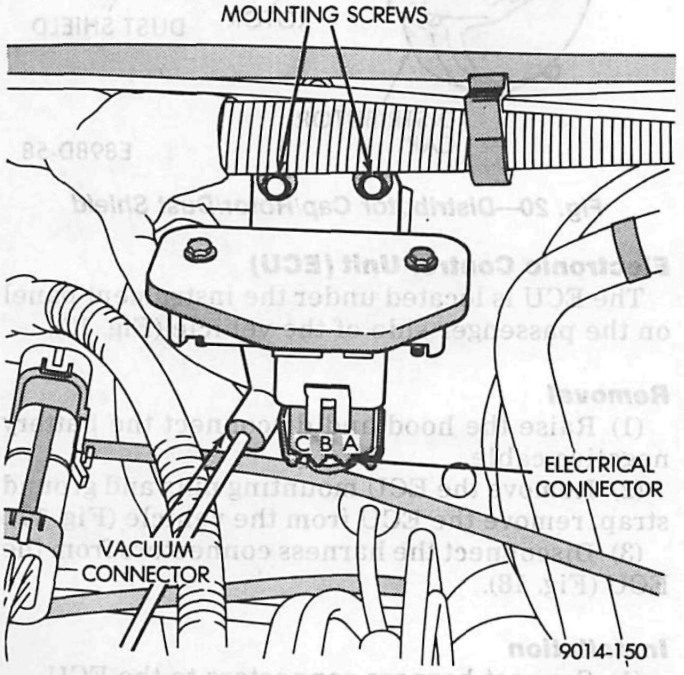


Fig. 15—MAP Sensor Removal/Installation

Removal

(1) Disconnect electrical connector (Fig. 14).
(2) Unscrew MAT sensor from the adaptor.

Installation

(1) Install MAT sensor in throttle body adapter (Fig. 14).
(2) Tighten the MAT sensor to 28 N·m (21 ft-lbs) torque.
(3) Connect electrical connector.

Manifold Absolute Pressure (MAP) Sensor

The Manifold Absolute Pressure (MAP) Sensor is located on the dash panel, next to the Brake Power Booster (Fig. 15).

Removal

(1) Disconnect electrical connector from MAP sensor (Fig. 15).
(2) Disconnect vacuum hose from MAP sensor.
(3) Remove MAP sensor mounting screws.
(4) Remove MAP sensor.

Installation

(1) Install MAP sensor on the dash panel with mounting screws. Tighten the mounting screws.
(2) Connect vacuum hose to MAP sensor.
(3) Connect electrical connector to MAP sensor.

Engine Speed Sensor (Crankshaft Position Sensor—CPS)

The Speed Sensor is located on the left side of the transmission converter housing behind the rear face of the engine (Fig. 16).

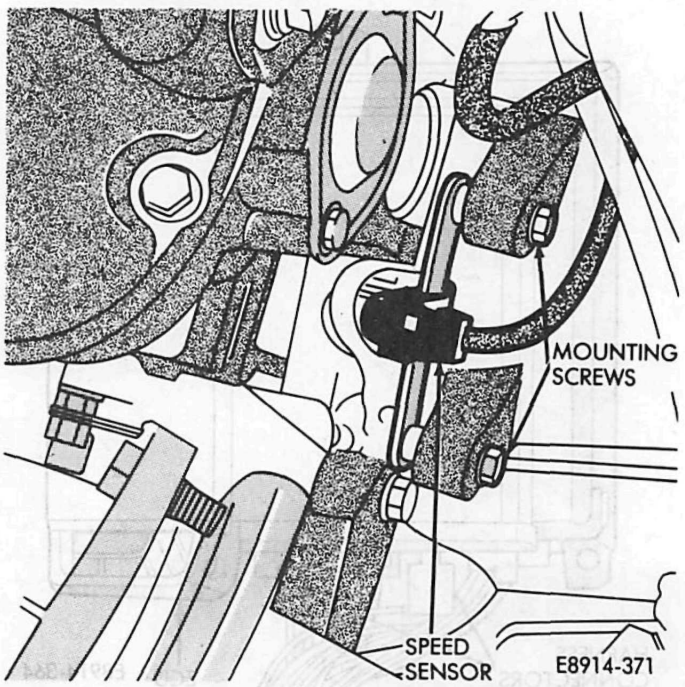


Fig. 16—Engine Speed Sensor Removal/Installation

Removal

(1) Remove the speed sensor mounting screws (Fig. 16).
(2) Disconnect speed sensor wire connector.
(3) Remove speed sensor.

Installation

(1) Install speed sensor (Fig. 16).
(2) Tighten mounting screws to 8 N·m (71 in-lbs) torque.
(3) Connect wire connector to speed sensor.

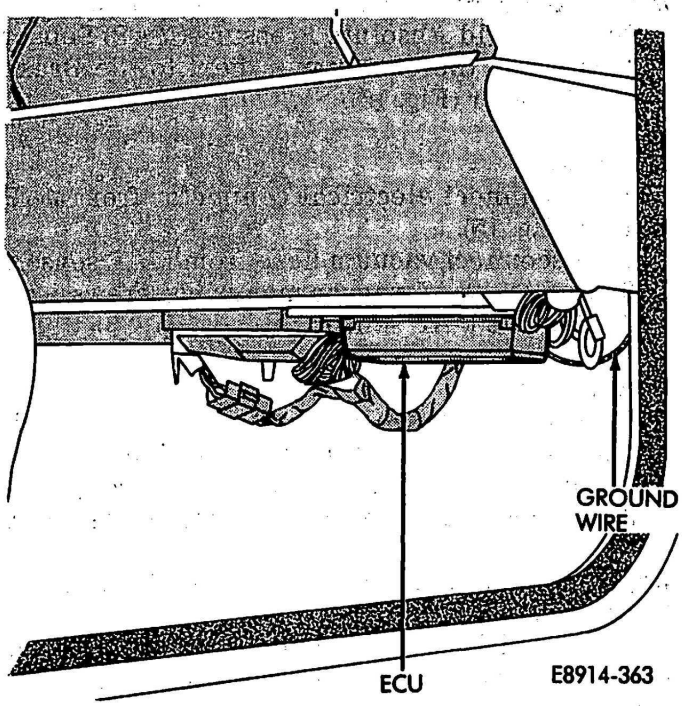


Fig. 17—ECU Removal/Installation

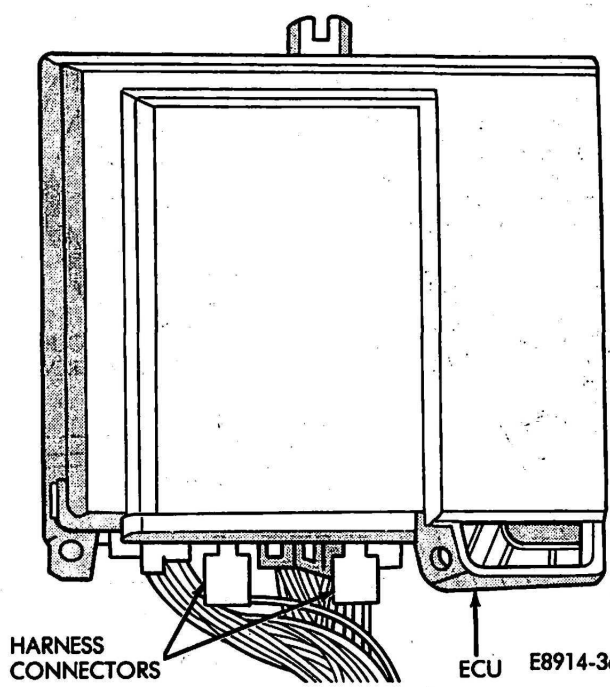


Fig. 18—ECU Connectors

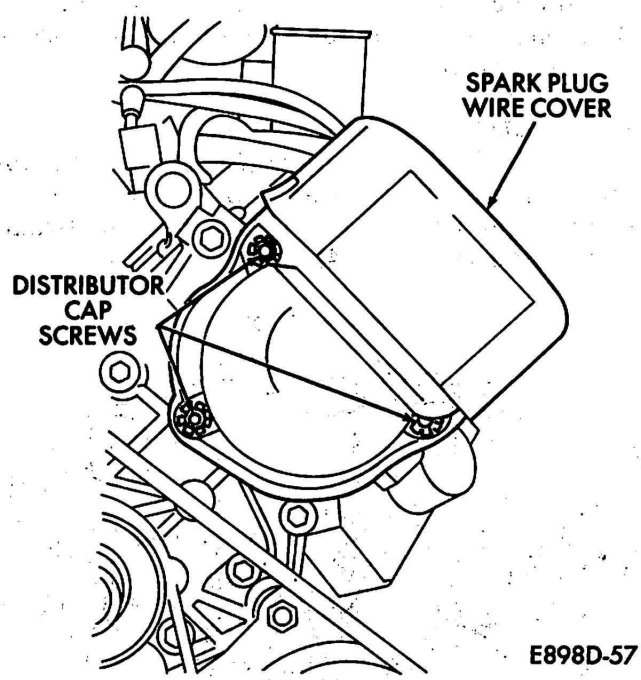


Fig. 19—Distributor Cap Removal/Installation

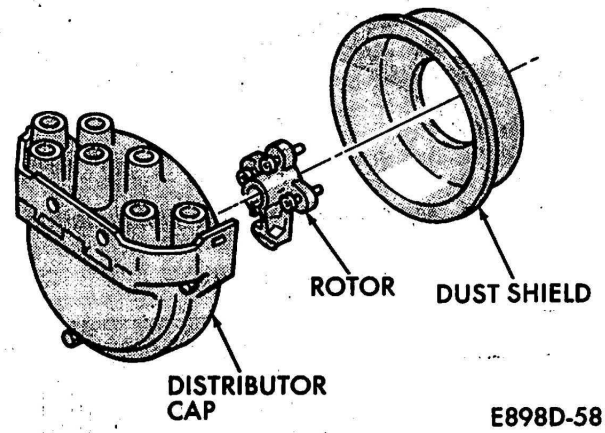


Fig. 20—Distributor Cap/Rotor/Dust Shield

Electronic Control Unit (ECU)

The ECU is located under the instrument panel on the passenger side of the vehicle (Fig. 17).

Removal

(1) Raise the hood and disconnect the battery negative cable.
(2) Remove the ECU mounting nuts and ground strap, remove the ECU from the vehicle (Fig. 17).
(3) Disconnect the harness connectors from the ECU (Fig. 18).

Installation

(1) Connect harness connectors to the ECU.
(2) Push the ECU over the positioning studs.

(3) Install the ground strap and tighten the mounting nuts.
(4) Connect the battery negative cable.
(5) Close the hood.

DISTRIBUTOR CAP/ROTOR/DUST SHIELD REPLACEMENT

The Distributor Cap/Rotor/Dust Shield assembly is located at the front of the left hand cylinder head.

(1) Remove cover over the spark plug wires (Fig. 19).
(2) Remove distributor cap mounting screws.
(3) Remove three screws and the rotor (Fig. 20).
(4) Remove the dust shield.
(5) Transfer the spark plug wires to the new distributor cap. Refer to Specifications for the firing order.
(6) Reverse the removal procedures to install the Distributor Cap/Rotor/Dust Shield.

KEY/LOCK CYLINDER

REMOVAL

(1) Unsnap the horn button (Fig. 1).
(2) Disconnect wires (Fig. 1) and remove the horn button.

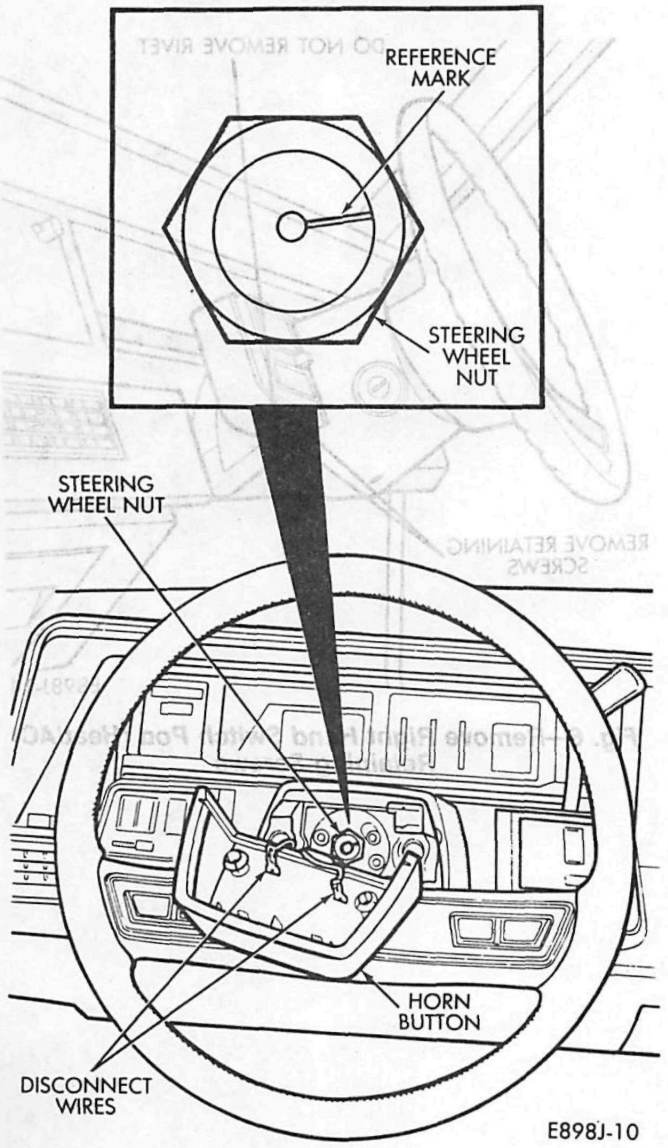


Fig. 1—Remove Horn Button

(3) Note position of the reference mark (Fig. 1) on the end of the steering shaft.

It is not necessary to use a puller to remove the steering wheel from the shaft.

(4) Remove the steering wheel nut (Fig. 1) and slide the steering wheel off the shaft.
(5) Disconnect electrical connector (Fig. 2) and remove the steering wheel.
(6) Remove turn signal cancel cam (Fig. 3) by unhooking tabs and sliding cancel cam off steering column.

Three small bent paper clips may be used to hold the tabs away from the shaft while sliding the cam off.

(7) If vehicle is equipped with tilt wheel remove tilt wheel control lever (Fig. 4).
(8) Remove the bottom two retaining screws from the left hand switch pod assembly (Fig. 5).

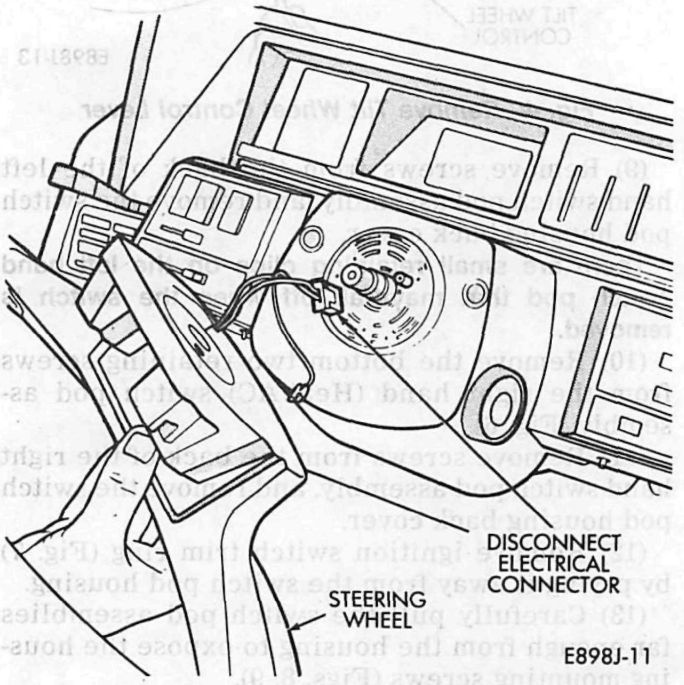


Fig. 2—Remove Steering Wheel

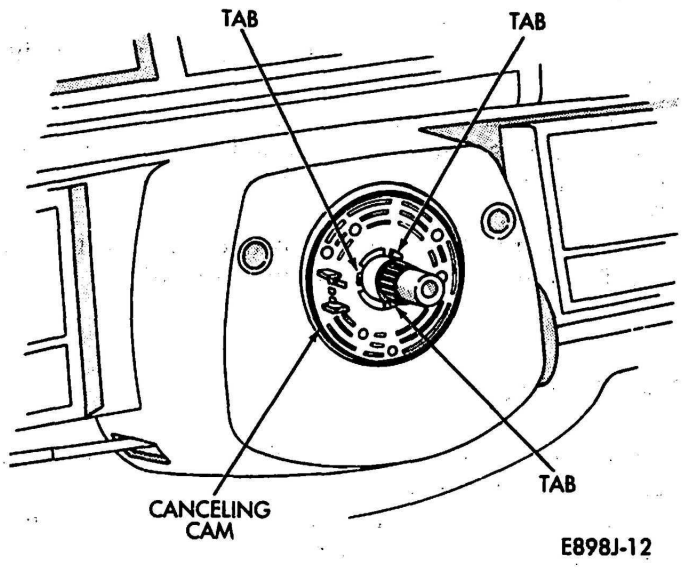


Fig. 3—Remove Turn Signal Cancel Cam

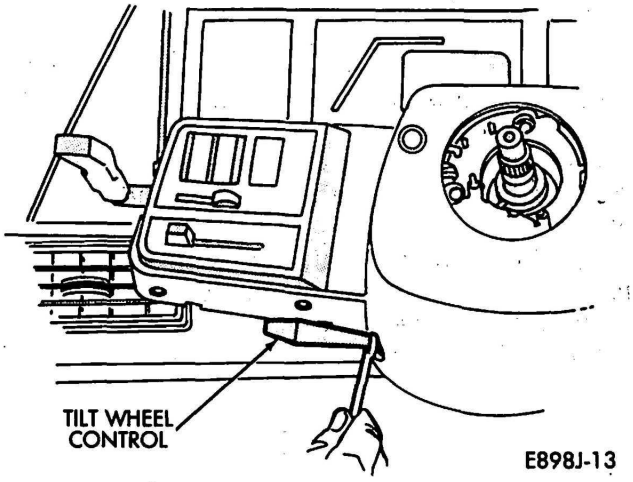


Fig. 4—Remove Tilt Wheel Control Lever

(9) Remove screws from the back of the left hand switch pod assembly, and remove the switch pod housing back cover.

There are small retaining clips on the left hand switch pod that may fall off when the switch is removed.

(10) Remove the bottom two retaining screws from the right hand (Heat/AC) switch pod assembly (Fig. 6).

(11) Remove screws from the back of the right hand switch pod assembly, and remove the switch pod housing back cover.

(12) Remove ignition switch trim ring (Fig. 7) by prying it away from the switch pod housing.

(13) Carefully pull the switch pod assemblies far enough from the housing to expose the housing mounting screws (Figs. 8, 9).

(14) Remove two left hand switch pod housing mounting screws (Fig. 8).

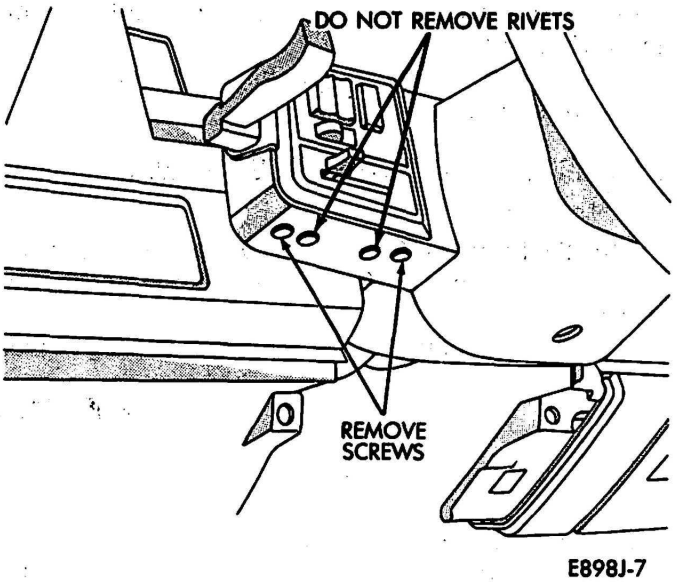


Fig. 5—Remove Screws

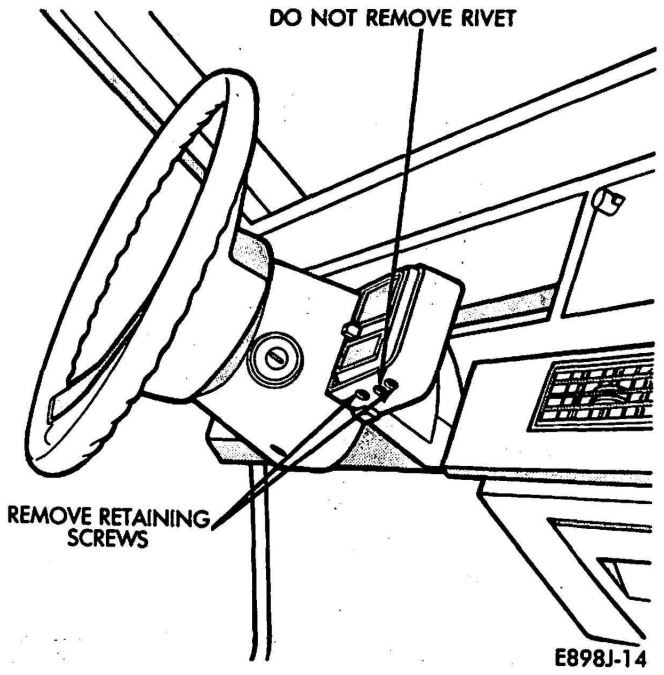


Fig. 6—Remove Right Hand Switch Pod (Heat/AC) Retaining Screws

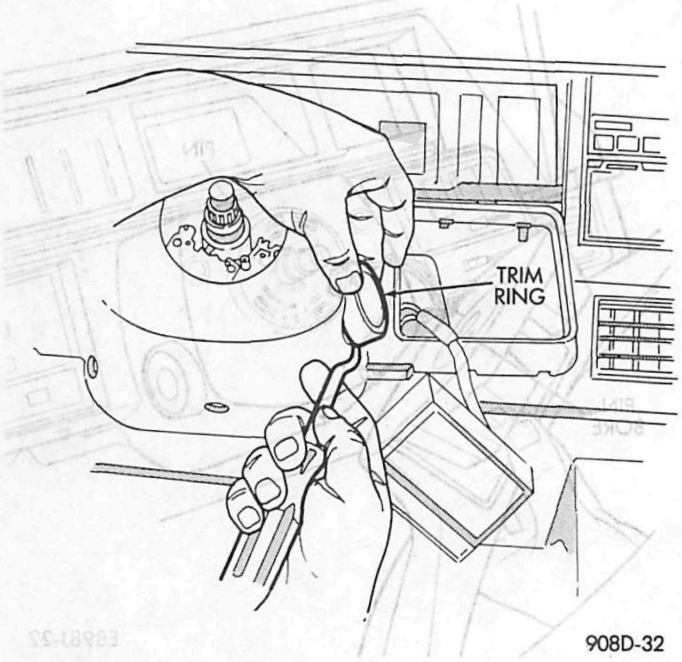


Fig. 7—Remove Ignition Switch Trim Ring

(15) Remove two right hand switch pod housing mounting screws (Fig. 9).

(16) Pass both switch pod assemblies through the back openings in the switch pod housing.

(17) Place key in unmarked position lining up key with groove (Fig. 10) in lock cylinder housing.

(18) Press locking tab (Fig. 10) from underneath as shown.

(19) With tab depressed remove lock cylinder.

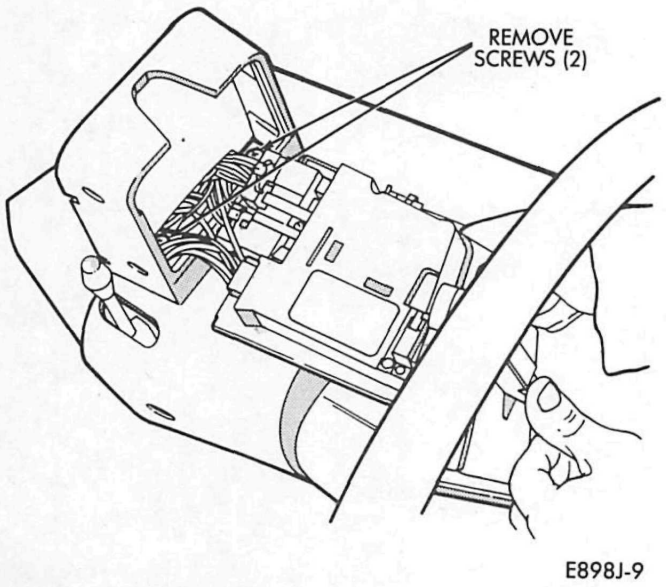


Fig. 8—Remove Two Screws

INSTALLATION

(1) Place key in unmarked position lining up key with groove (Fig. 11).

(2) Depress tab.

(3) Slide lock cylinder into cylinder housing.

(4) Reverse the remaining removal procedures to complete the key/lock cylinder replacement.

There are small retaining clips on the left hand and right hand switch pods that must be in place when the switches are installed.

(5) Align the pin (Fig. 12) on the turn signal cam with the pin bore in the steering wheel and start the wheel onto the steering shaft.

(6) Align the steering wheel with the reference mark on the steering shaft and seat the wheel on the shaft.

(7) Install and tighten the steering wheel nut to 70 N·m (52 ft-lbs) torque.

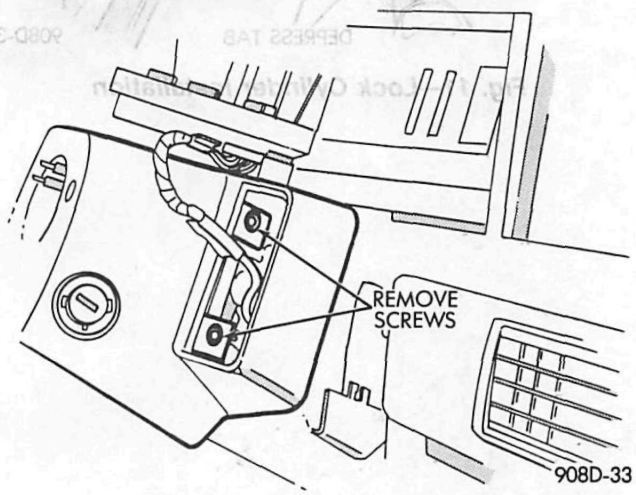


Fig. 9—Remove Two Screws

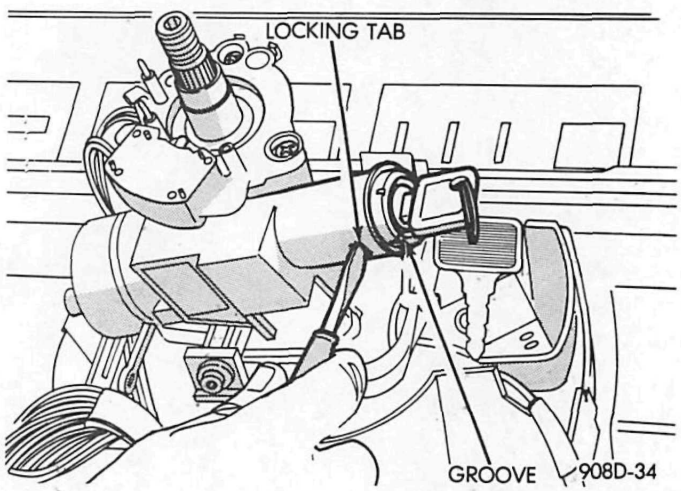


Fig. 10—Line Up Key With Groove

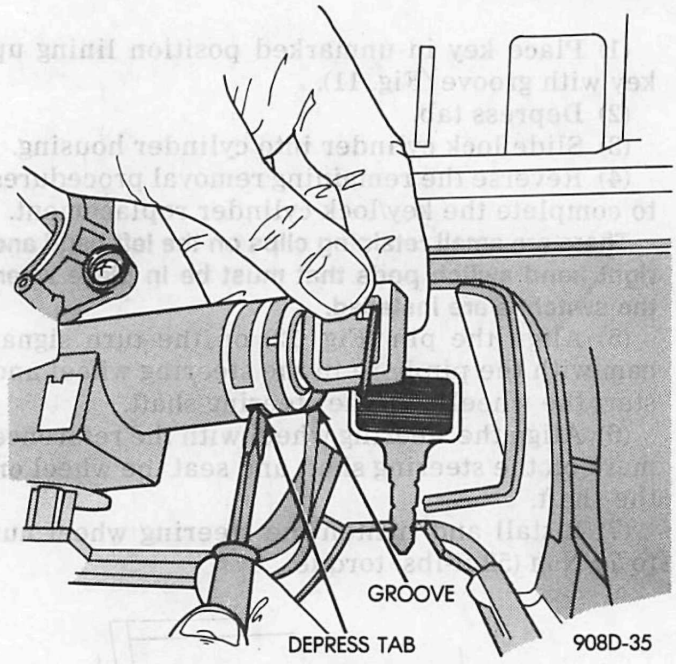


Fig. 11—Lock Cylinder Installation

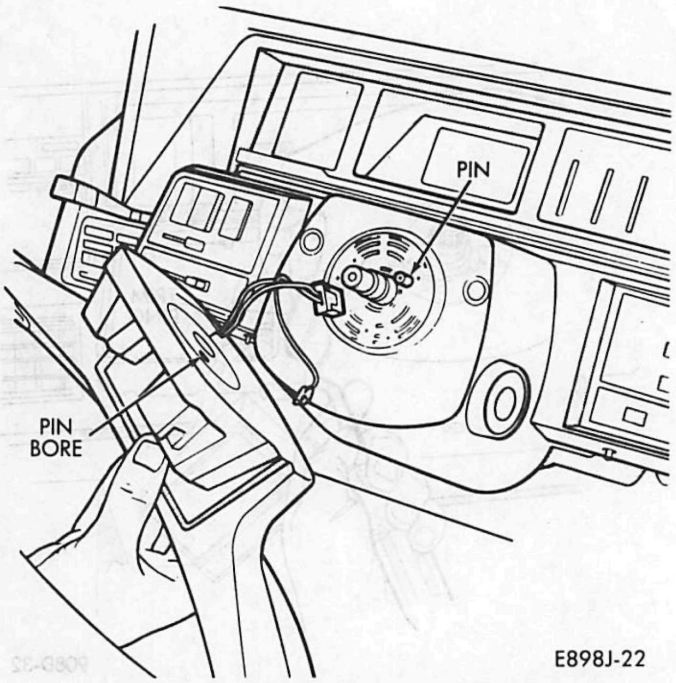


Fig. 12—Steering Wheel Alignment

IGNITION SWITCH

REMOVAL

(1) Remove screws and instrument panel lower cover if equipped (Fig. 1).
(2) Unsnap the horn button (Fig. 2).
(3) Disconnect wires (Fig. 2) and remove the horn button.
(4) Note position of the reference mark (Fig. 2) on the end of the steering shaft.

It is not necessary to use a puller to remove the steering wheel from the shaft.

(5) Remove the steering wheel nut (Fig. 2) and slide the steering wheel off the shaft.
(6) Disconnect electrical connector (Fig. 3) and remove the steering wheel.
(7) Remove turn signal cancel cam (Fig. 4) by unhooking tabs and sliding cancel cam off steering column.

Three small bent paper clips may be used to hold the tabs away from the shaft while sliding the cam off.

(8) If vehicle is equipped with tilt wheel remove tilt wheel control lever (Fig. 5).

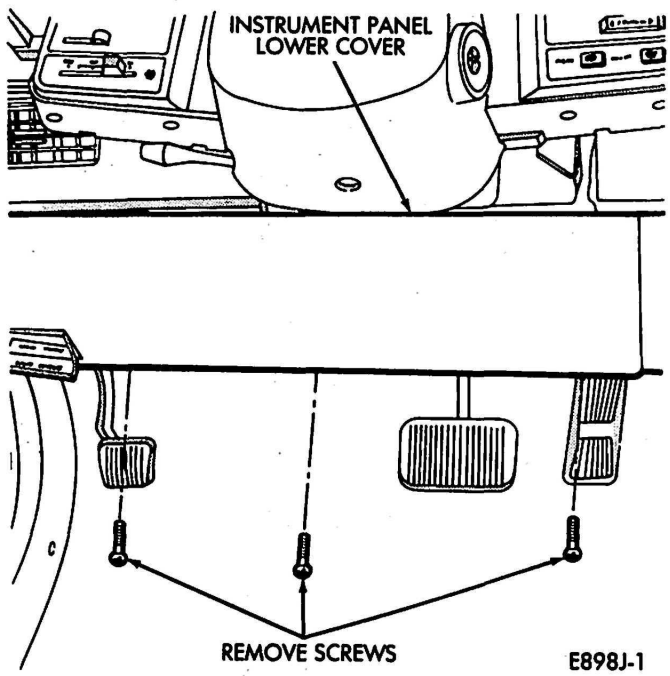


Fig. 1—Remove Instrument Panel Lower Cover

(9) Remove the bottom two retaining screws from the left hand switch pod assembly (Fig. 6).
(10) Remove screws from the back of the left hand switch pod assembly, and remove the switch pod housing back cover.

There are small retaining clips on the left hand switch pod that may fall off when the switch is removed.

(11) Remove the bottom two retaining screws from the right hand (Heat/AC) switch pod assembly (Fig. 7).
(12) Remove screws from the back of the right hand switch pod assembly, and remove the switch pod housing back cover.
(13) Remove ignition switch trim ring (Fig. 8) by prying it away from the switch pod housing.

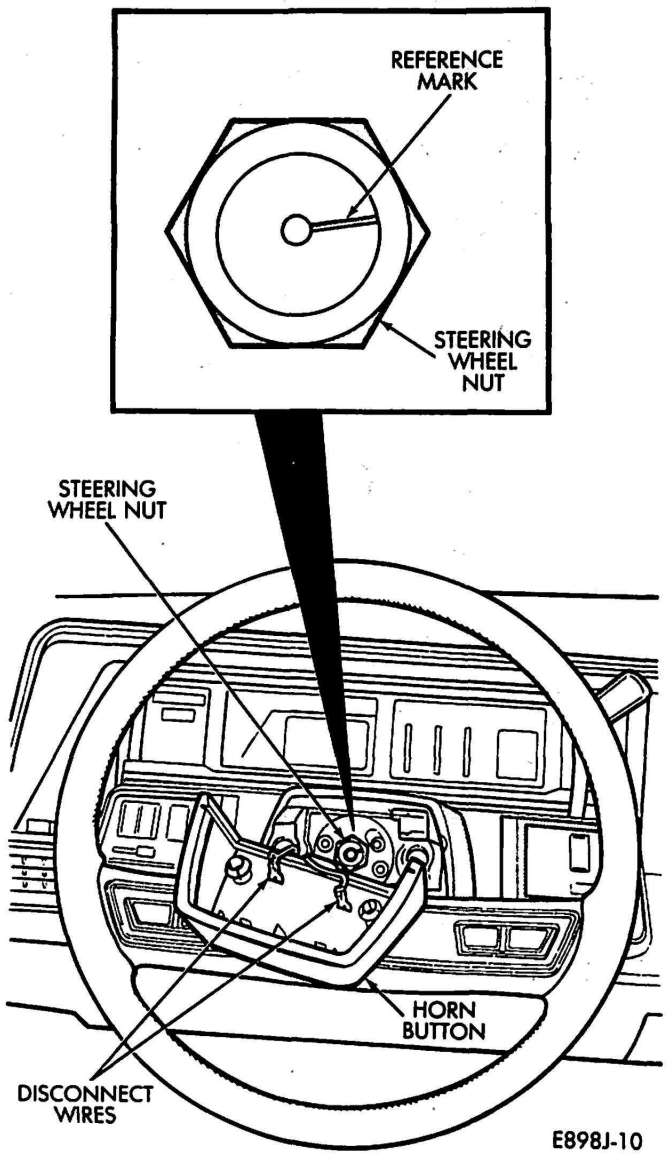


Fig. 2—Remove Horn Button

(14) Carefully pull the switch pod assemblies far enough from the housing to expose the housing mounting screws (Figs. 9, 10).

(15) Remove two left hand switch pod housing mounting screws (Fig. 9).

(16) Remove two right hand switch pod housing mounting screws (Fig. 10).

(17) Pass both switch pod assemblies through the back openings in the switch pod housing.

(18) Remove screw holding lower column shroud (Fig. 11).

(19) Separate and remove the lower column shroud.

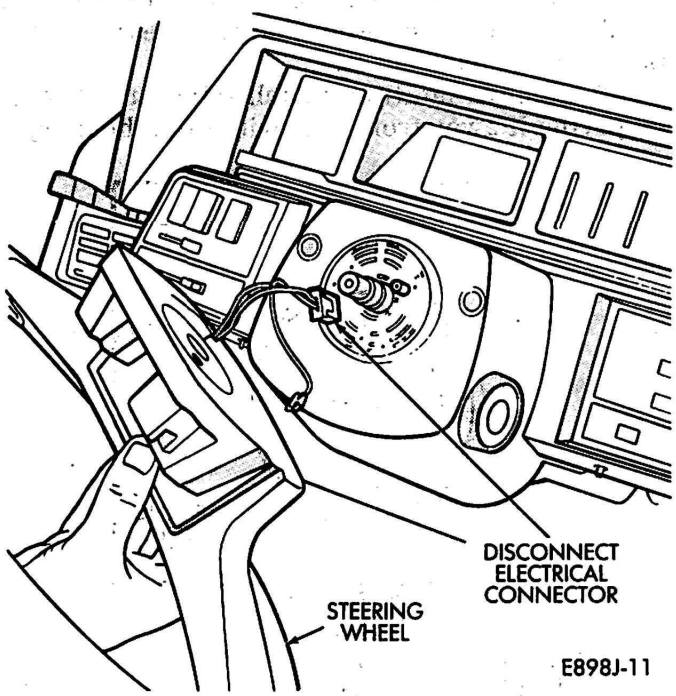


Fig. 3—Remove Steering Wheel

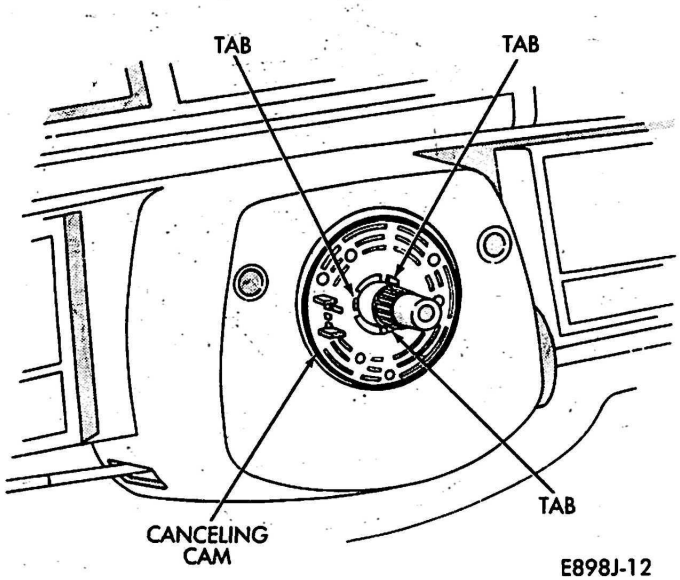


Fig. 4—Remove Turn Signal Cancel Cam

(20) Remove two screws (Fig. 12) and remove upper column shroud.

(21) Remove ignition switch retaining screws (Fig. 13).

(22) Separate ignition switch from lock cylinder housing.

(23) Cut tie straps (Fig. 14).

(24) Remove screw and remove harness anchor (Fig. 15).

(25) Loosen holddown nut (Fig. 16) in center of steering column connector.

(26) Separate the module connectors (Fig. 17) from the steering column connector by placing a flat blade screwdriver between the connectors to disengage locking tab. Push on the wire side of the left hand switch (headlight) pad connector and slide the connector out of the channels of the steering column connector.

Remove ignition switch and harness.

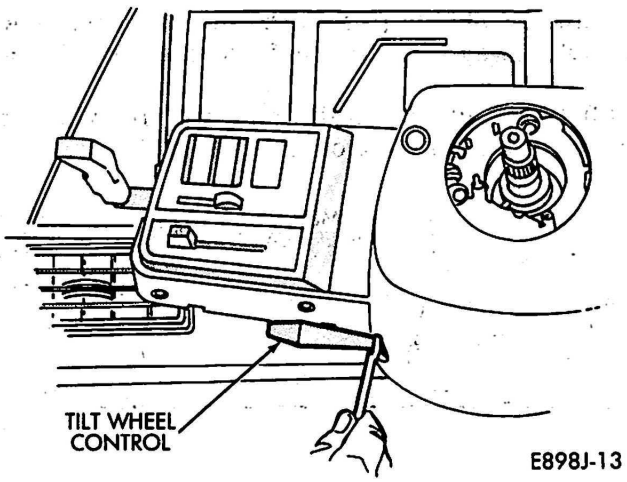


Fig. 5—Remove Tilt Wheel Control Lever

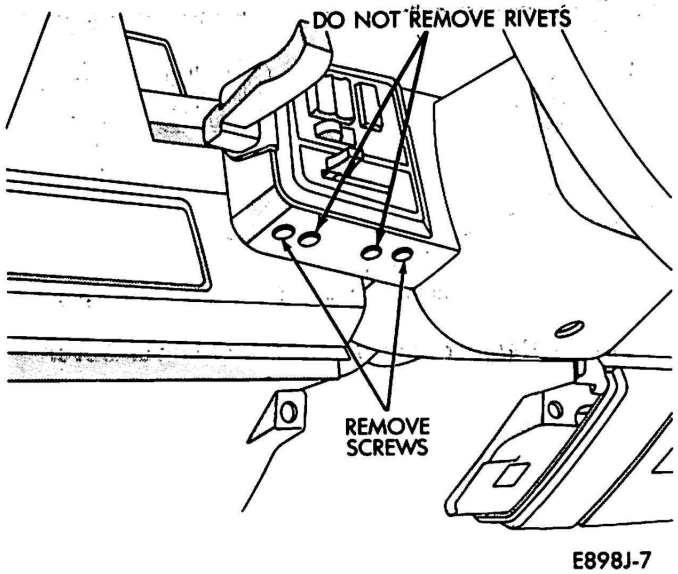


Fig. 6—Remove Screws

INSTALLATION

(1) Slide switch pod connectors into ignition switch connector from wire side and install nut.
(2) Position ignition switch and secure with screws.
(3) Route harnesses along underside of steering column and secure harnesses to column with tie straps.

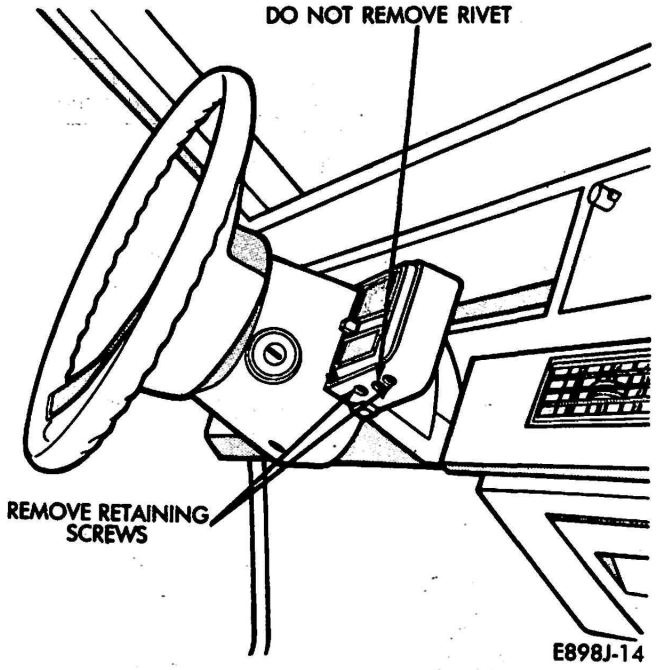


Fig. 7—Remove Right Hand Switch Pod (Heat/AC) Retaining Screws

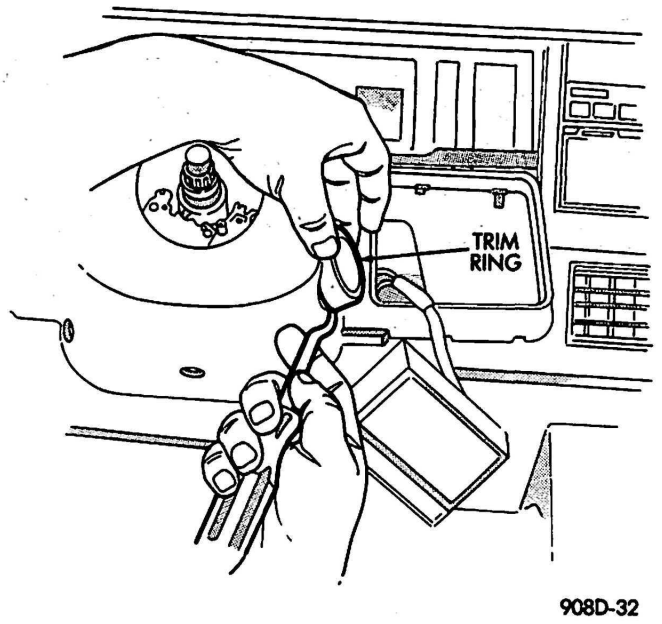


Fig. 8—Remove Ignition Switch Trim Ring

(4) Install harness anchor and secure to column with screw.
(5) Reverse the remaining removal procedures to complete the ignition switch replacement.
There are small retaining clips on the left hand switch pod that must be in place when the switches are installed.
(6) Align the pin (Fig. 18) on the turn signal cam with the pin bore in the steering wheel and start the wheel onto the steering shaft.
(7) Align the steering wheel with the reference mark on the steering shaft and seat the wheel on the shaft.
(8) Install and tighten the steering wheel nut to 70 N·m (52 ft-lbs) torque.

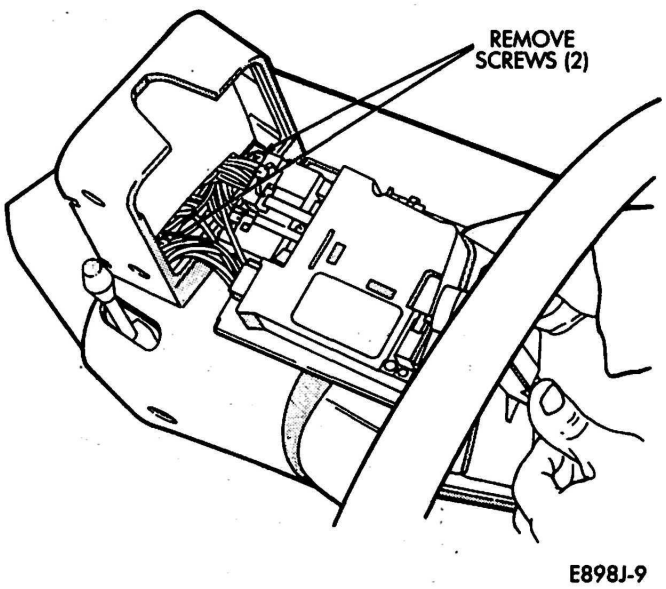


Fig. 9—Remove Two Screws

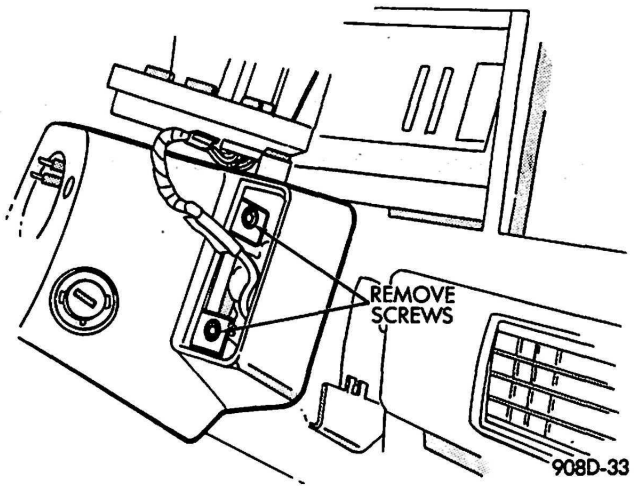


Fig. 10—Remove Two Screws

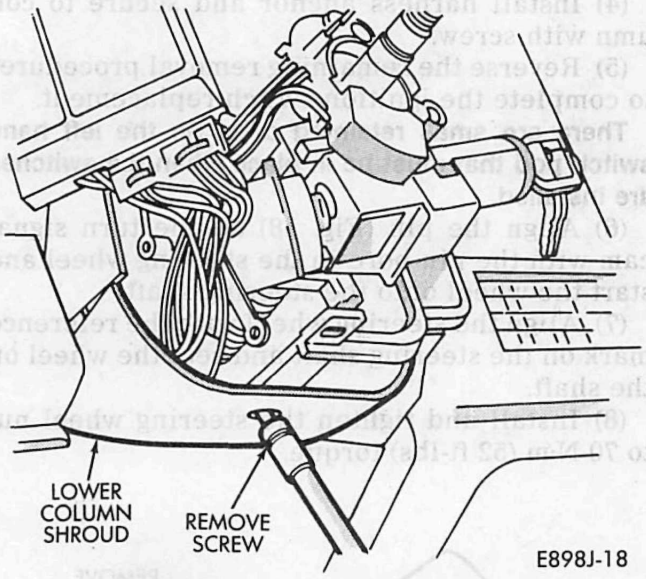


Fig. 11—Remove Lower Shroud Screw

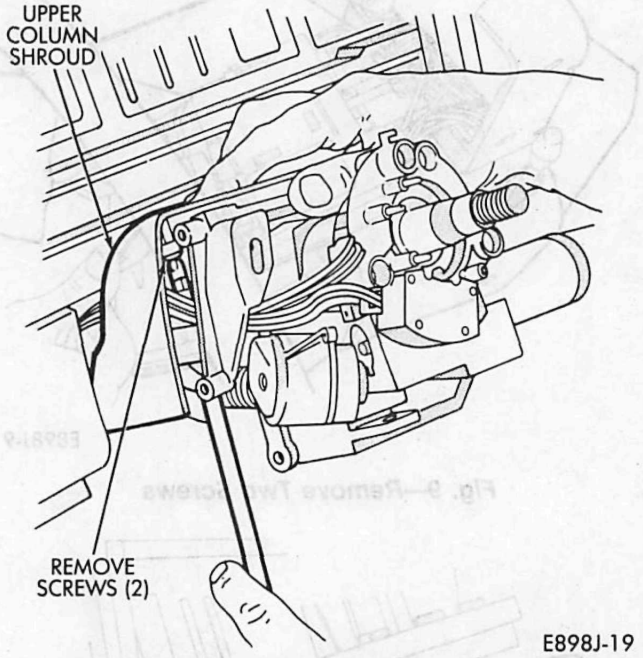


Fig. 12—Remove Two Upper Shroud Screws

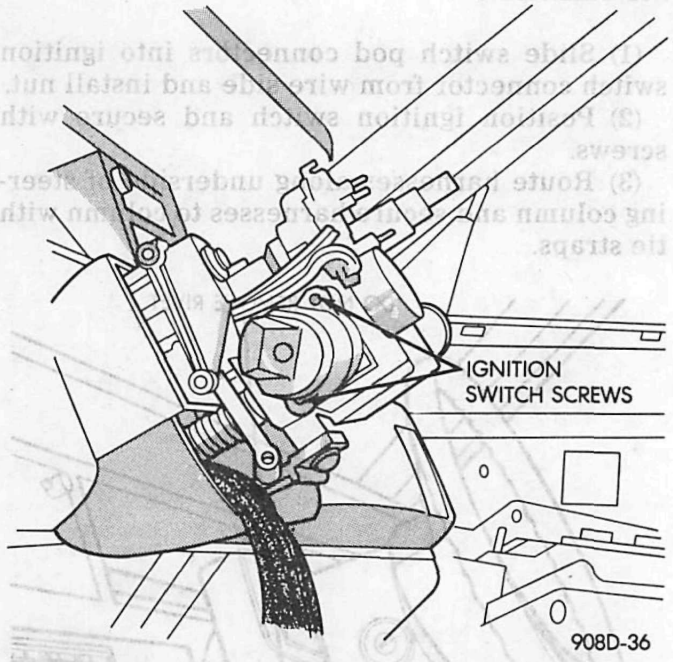


Fig. 13—Remove Ignition Switch Screws

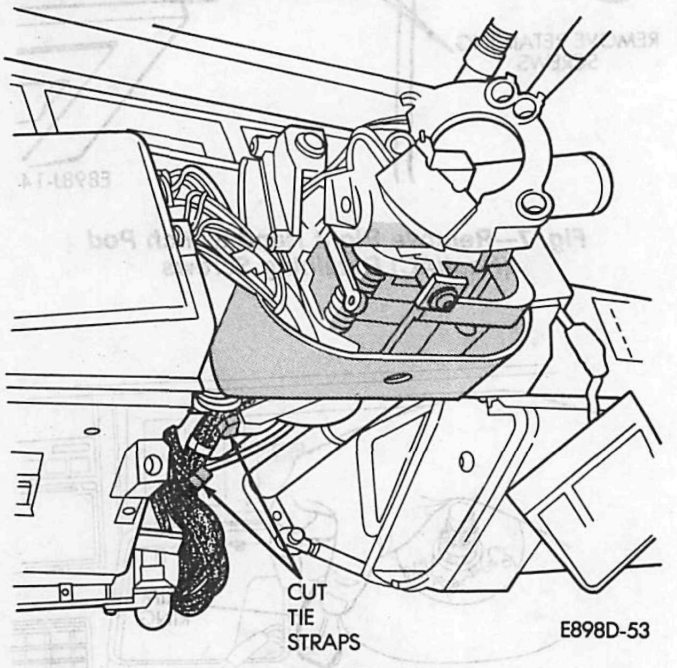


Fig. 14—Cut Tie Straps

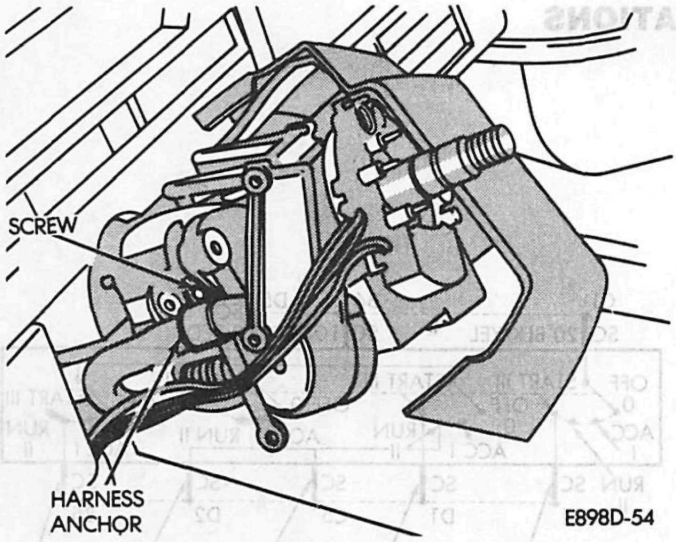


Fig. 15—Remove Harness Anchor

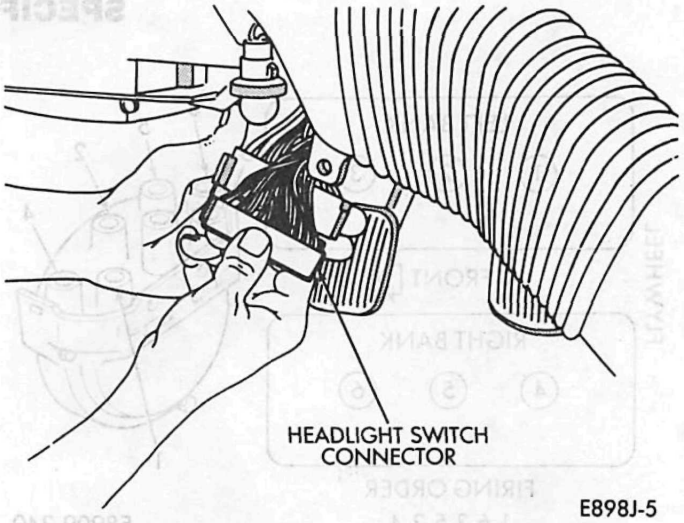


Fig. 17—Separate Switch Pod Connectors

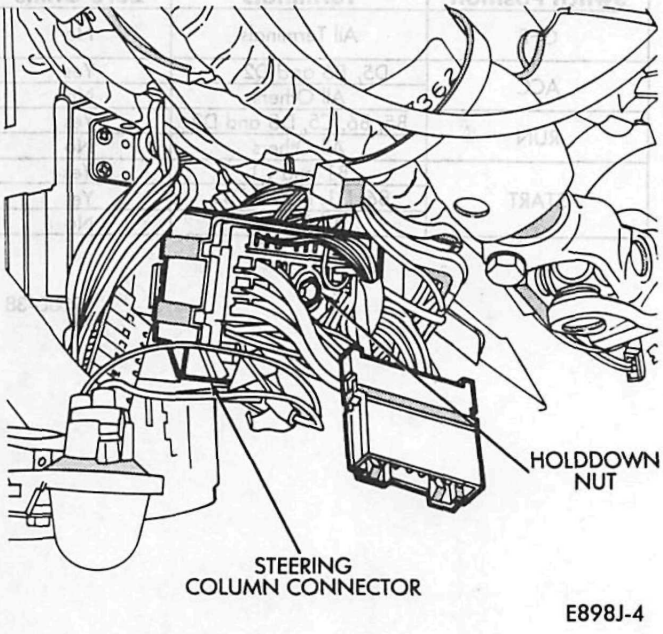


Fig. 16—Loosen Holddown Nut

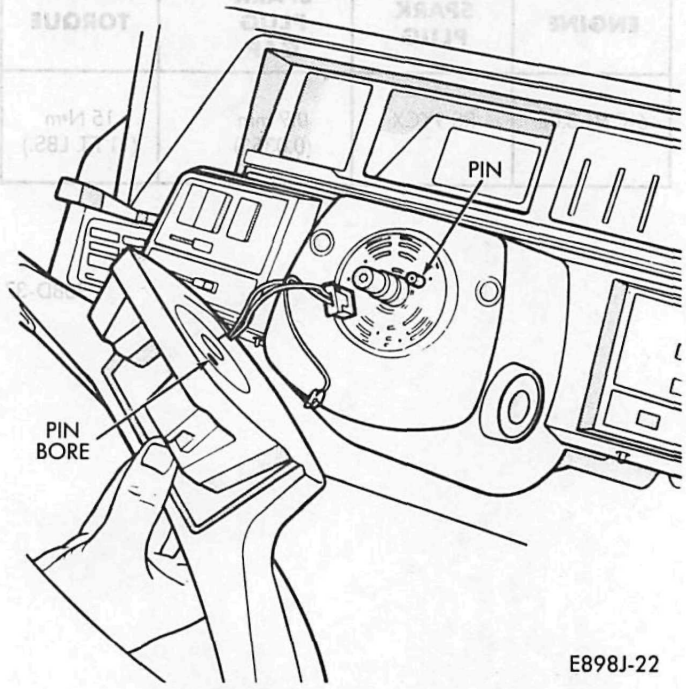
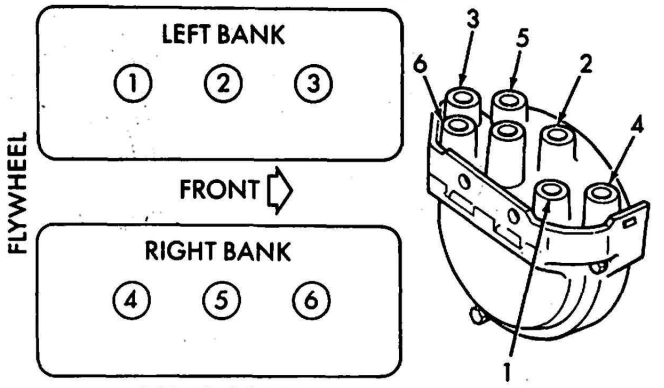


Fig. 18—Steering Wheel Alignment

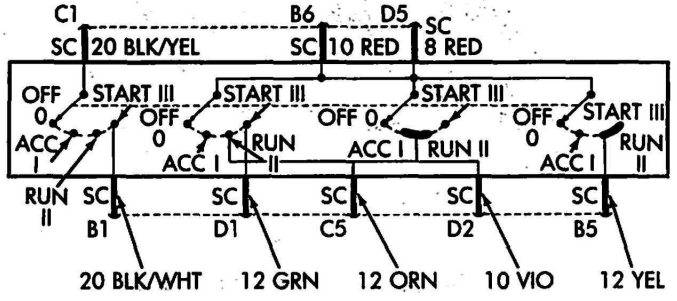
SPECIFICATIONS



E8909-240

ENGINE	SPARK PLUG	SPARK PLUG GAP	TORQUE
6-CYL. 3.0L	RS 9YCX	0.9 mm (0.035")	15 N•m (11 FT. LBS.)

908D-37



Switch Position	Terminals	Zero Ohms
OFF	All Terminals	No
ACC	D5, B6 and D2	Yes
	All Others	No
RUN	B5, B6, C5, D5 and D2	Yes
	All Others	No
START	B1 and C1	Yes
	B6, D1, D5 and B5	Yes
	All Others	No

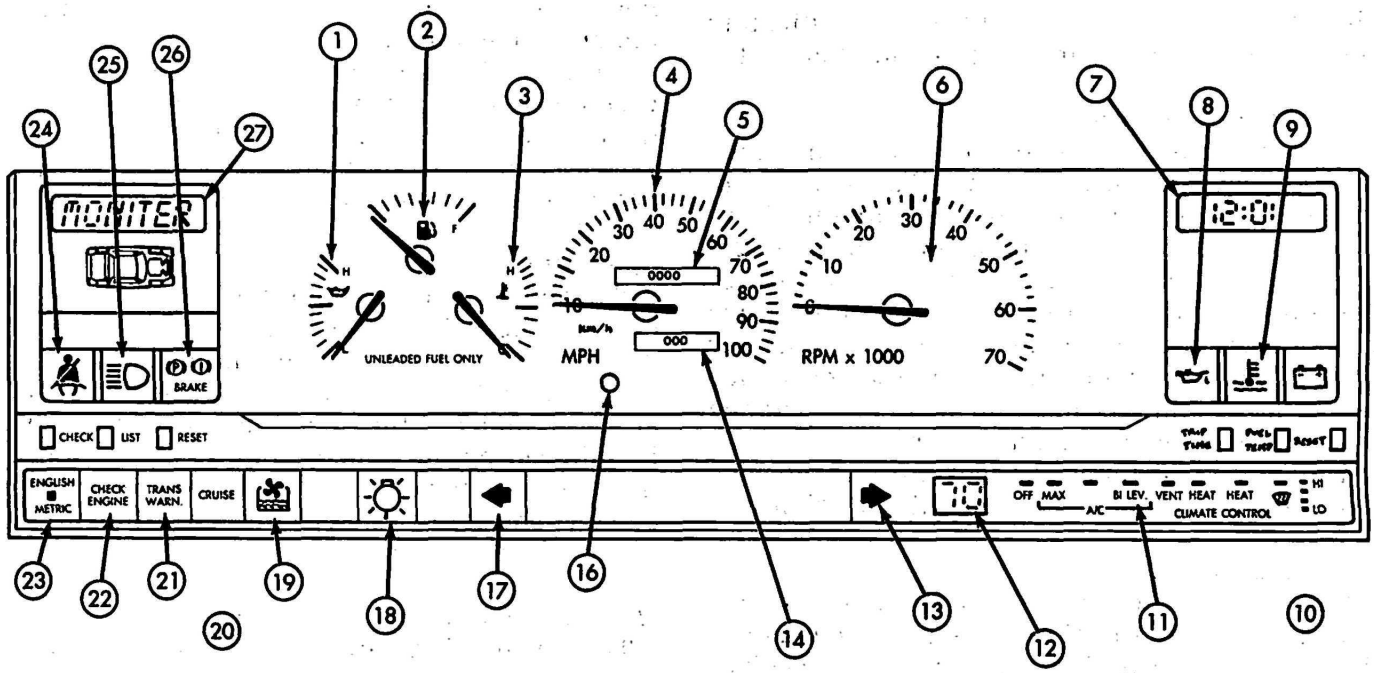
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INSTRUMENT PANEL

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CLUSTER DESCRIPTION



1 OIL PRESSURE GAUGE
2 FUEL GAUGE
3 ENGINE COOLANT TEMPERATURE GAUGE
4 SPEEDOMETER
5 ODOMETER
6 TACHOMETER
7 TRIP COMPUTER
8 OIL PRESSURE WARNING LIGHT
9 ENGINE COOLANT WARNING LIGHT
10 ALTERNATOR WARNING LIGHT
11 CLIMATE CONTROL INDICATOR LIGHTS
12 INTERIOR TEMPERATURE INDICATOR
13 RIGHT TURN SIGNAL INDICATOR LIGHT
14 TRIP ODOMETER
16 TRIP ODOMETER RESET KNOB
17 LEFT TURN SIGNAL INDICATOR LIGHT
18 PARKING/HEADLAMPS INDICATOR LIGHT
19 LOW COOLANT CAUTION LIGHT (VMM)
20 CRUISE CONTROL INDICATOR LIGHT
21 TRANSMISSION WARNING LIGHT
22 CHECK ENGINE LAMP
23 ENGLISH/METRIC DISPLAY SELECT BUTTON
24 SEAT BELT WARNING LIGHT
25 HEADLAMP HIGH BEAM INDICATOR LIGHT
26 BRAKE WARNING LIGHT
27 VEHICLE MAINTENANCE MONITOR (VMM)

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ELECTRICAL DIAGNOSIS

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General Information	2
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GENERAL INFORMATION

With the ignition switch in the RUN position, voltage is applied to fuse 10. With the ignition switch in RUN or START, voltage is applied to fuse 15. The voltage applied to the instrument cluster is applied to all gauges and indicators through the instrument cluster printed circuit.

Temperature Gauge

Current through the coils of the coolant gauge creates two opposing magnetic fields that control the position of the needle. Current flows through each coil. One path goes through the lower coil to ground. The other flows through the upper coil and the coolant temperature sender to ground. The coolant temperature sender is a variable resistor. It has a low resistance when the coolant is hot and a high resistance when the coolant is cool. Current through the coils varies as the resistance changes, varying the magnetic fields that control the needle position.

Tachometer

With the ignition switch in RUN or START, voltage is applied to the solid-state tachometer. With the engine running, the tachometer receives an engine speed signal from the negative side of the ignition coil and displays the engine speed.

Fuel Gauge

Current flowing through the coils of the fuel gauge creates two opposing magnetic fields that control the position of the needle. Current flows through the upper coil and divides. One path goes through the lower coil to ground. The other flows through the upper coil and the fuel gauge sender to ground. The fuel gauge sender is a variable resistor. Current through the coils varies as the resistance changes, varying the magnetic fields that control the needle position. A low fuel indicator is part of the fuel gauge and lights when the tank is near empty.

Oil Gauge

Current flowing through the coils of the oil gauge creates two opposing magnetic fields that control the position of the needle. Current flows through each coil. One path goes through the lower coil to ground. The other flows through the upper coil and the oil pressure sender/switch to ground. The oil pressure sender/switch is a variable resistor. It has a low resistance when the oil pressure is low. Current through the coils varies as the resistance changes, varying the magnetic fields that control the needle position.

Speedometer

The speedometer is operated by an electronic circuit. The vehicle speed sensor generates an AC voltage whose frequency is proportional to the speed of the vehicle. This voltage is an input at pins 4 and 7 of the speed module. This signal is buffered by the speed module, and is sent to the speedometer circuit board in the instrument cluster. The solid state circuit drives the pointer of the speedometer.

Warning Indicators

The warning indicators receive battery voltage from fused 10 and 15 with the ignition switch in ACC or RUN. All warning indicators require a ground signal to turn on the indicator.

DIAGNOSING GAUGES (Figs. 1, 2)

More Than One Indicator Or Gauge Does Not Operate

1. IGNITION SWITCH IN RUN

TEST	OK	NOT OK
Inspect Fuse 10 and 15	Not blown	Replace blown fuse
Battery side of fuse	Battery voltage	Repair open from ignition switch
Instrument cluster Connector A - Terminals 16 and 10	Battery voltage	Repair open from fuse
Inspect instrument cluster printed circuit for cracks or poor contacts	Printed circuit OK	Replace printed circuit

2. IGNITION SWITCH OFF AND NEGATIVE BATTERY CABLE DISCONNECTED

TEST	OK	NOT OK
Instrument cluster Connector A - Terminal 14 to ground	Zero ohms	Repair open to ground

Coolant Temperature Gauge Does Not Operate (All Other Gauges Operate)

IGNITION IN RUN

TEST	OK	NOT OK
Disconnect Coolant Temperature Sender connector	Needle goes to full cold. If OK, go to next step	Check wire to cluster and printed circuit for a short to ground. If OK, replace instrument cluster gauges section
Momentarily touch Terminal 2 of Coolant Temperature Sender to ground	Needle goes to full hot. If OK, replace temperature sender	Check for open between sender and instrument cluster
Inspect instrument cluster printed circuit for cracks or poor connection	Replace instrument cluster gauges section	Replace printed circuit

Fuel Gauges Do Not Operate (All Other Gauges Operate)

IGNITION IN RUN

TEST	OK	NOT OK
Disconnect Fuel Tank Unit connector	Needle goes to full empty. If OK, go to next step	Check wire to cluster and printed circuit for a short to ground. If OK, replace instrument cluster gauges section
Momentarily touch Terminal C of Disconnect Fuel Tank Unit connector to ground	Needle goes to full mark. If OK, replace fuel gauge sender	Check for open between fuel gauge sender and instrument cluster
Inspect instrument cluster printed circuit for cracks or poor connection	Replace instrument cluster gauges section	Replace printed circuit

Tachometer Does Not Operate (All Other Gauges Operate)

ENGINE RUNNING

TEST	OK	NOT OK
Connect an AC voltmeter at ignition control module connector - Terminal A	Tachometer signal. Refer to table	Replace ignition coil
Connect an AC voltmeter at instrument cluster Connector B - Terminal 11	Tachometer signal. Refer to table	Repair open between ignition coil and instrument cluster
Inspect instrument cluster printed circuit for cracks or poor connection	Replace tachometer	Replace printed circuit

IGNITION CONTROL MODULE VOLTAGE (A.C.)			
ENGINE RPM	A.C. VOLTS	ENGINE RPM	A.C. VOLTS
1000	6.8	2500	10.7
1500	8.1	3000	12
2000	9.4	3500	13.3

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Oil Pressure Gauge Does Not Operate (All Other Gauges Operate)
IGNITION SWITCH IN RUN

TEST	OK	NOT OK
Disconnect the oil pressure sender/ switch connector	Needle goes to zero pressure	Check wires to cluster and printed circuit for an open. If OK, replace gauge section
Momentarily touch terminal S of the oil pressure sender/switch connector to ground	Needle goes to maximum pressure. If OK, replace the oil pressure sender switch	Check wire to cluster and printed circuit for an open. If OK, replace cluster gauge section

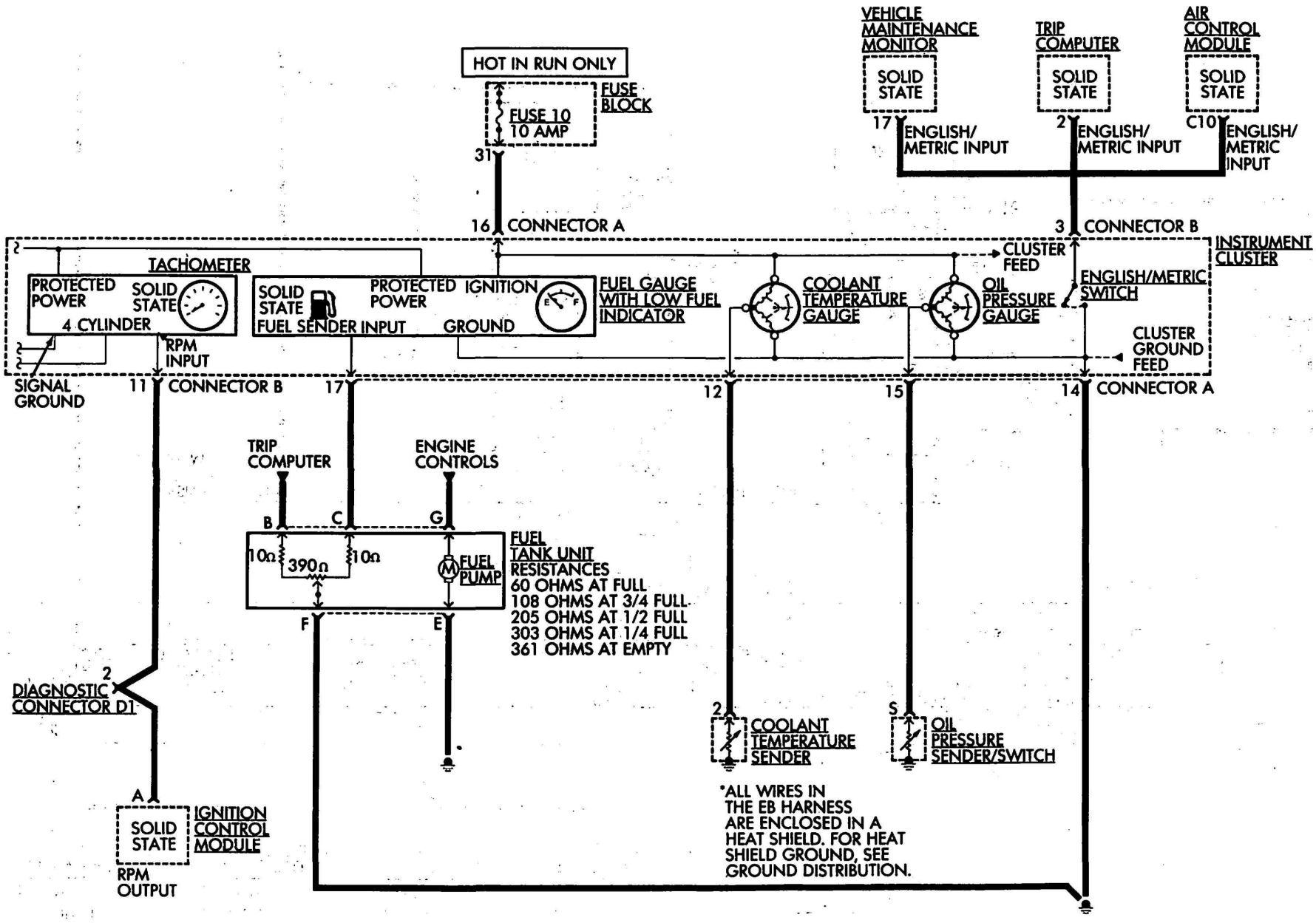
Speedometer Does Not Operate

TEST	OK	NOT OK
Operate cruise control	Check wires between speedometer and speed module. If OK, replace the instrument cluster	Check vehicle speed sensor. If OK, go to next step
Check vehicle speed sensor wire to cluster	Check power and ground wires to speed module. If OK, replace speed module	Repair/replace faulty wires

DIAGNOSING WARNING INDICATORS (Fig. 3)

Brake Indicator Stays On
IGNITION SWITCH IN RUN

TEST	OK	NOT OK
Disconnect Brake Warning Switch connector	Indicator goes out. If OK, replace brake warning switch	Go to next step
Disconnect Park Brake Switch connector	Indicator goes out. If OK, replace park brake switch	Repair short to ground in switch circuit to instrument cluster



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Fig. 1—Instrument Cluster Schematic

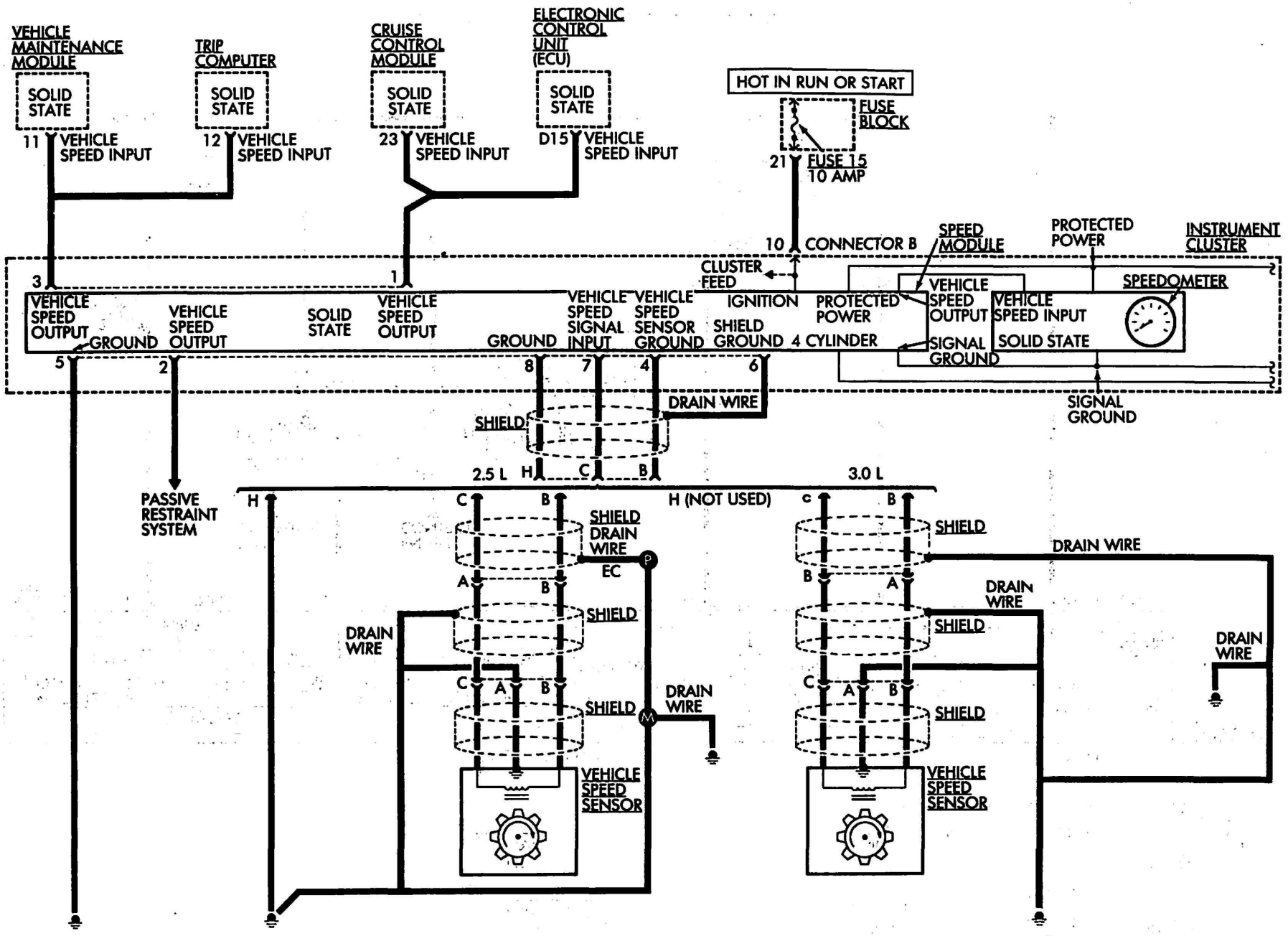


Fig. 2—Instrument Cluster Schematic

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Brake Indicator Does Not Come On With Low Brake Pressure Or With Parking Brake Engaged
IGNITION SWITCH IN RUN

TEST	OK	NOT OK
Jumper Park Brake Switch connector to ground	Indicator goes on. If OK, replace park brake switch	Repair open from instrument cluster
Jumper Brake Warning Switch connector - Terminal B to ground	Indicator goes on. If OK, go to next step	Repair open from instrument cluster
Jumper Brake Warning Switch connector - Terminal B to Terminal A	Indicator goes on. If OK, replace brake warning switch	Repair open from ground

High Temperature, Oil or Coolant Level Indicator Stays On
IGNITION SWITCH IN RUN

TEST	OK	NOT OK
Disconnect switch connector	Indicator goes out. If OK, replace switch	Repair short to ground between switch and instrument cluster

High Temperature, Oil or Coolant Level Indicator Does Not Come On
IGNITION SWITCH IN RUN

TEST	OK	NOT OK
Jumper switch connector to ground	Indicator goes on. If OK, replace switch. For coolant level indicator, check continuity of Coolant Level Switch connector - Terminal B to ground before replacing switch.	Go to next step
Check bulb	Zero ohms	Replace bulb
Check continuity between cluster and switch	Zero ohms. If OK, replace instrument cluster printed circuit	Repair open from instrument cluster



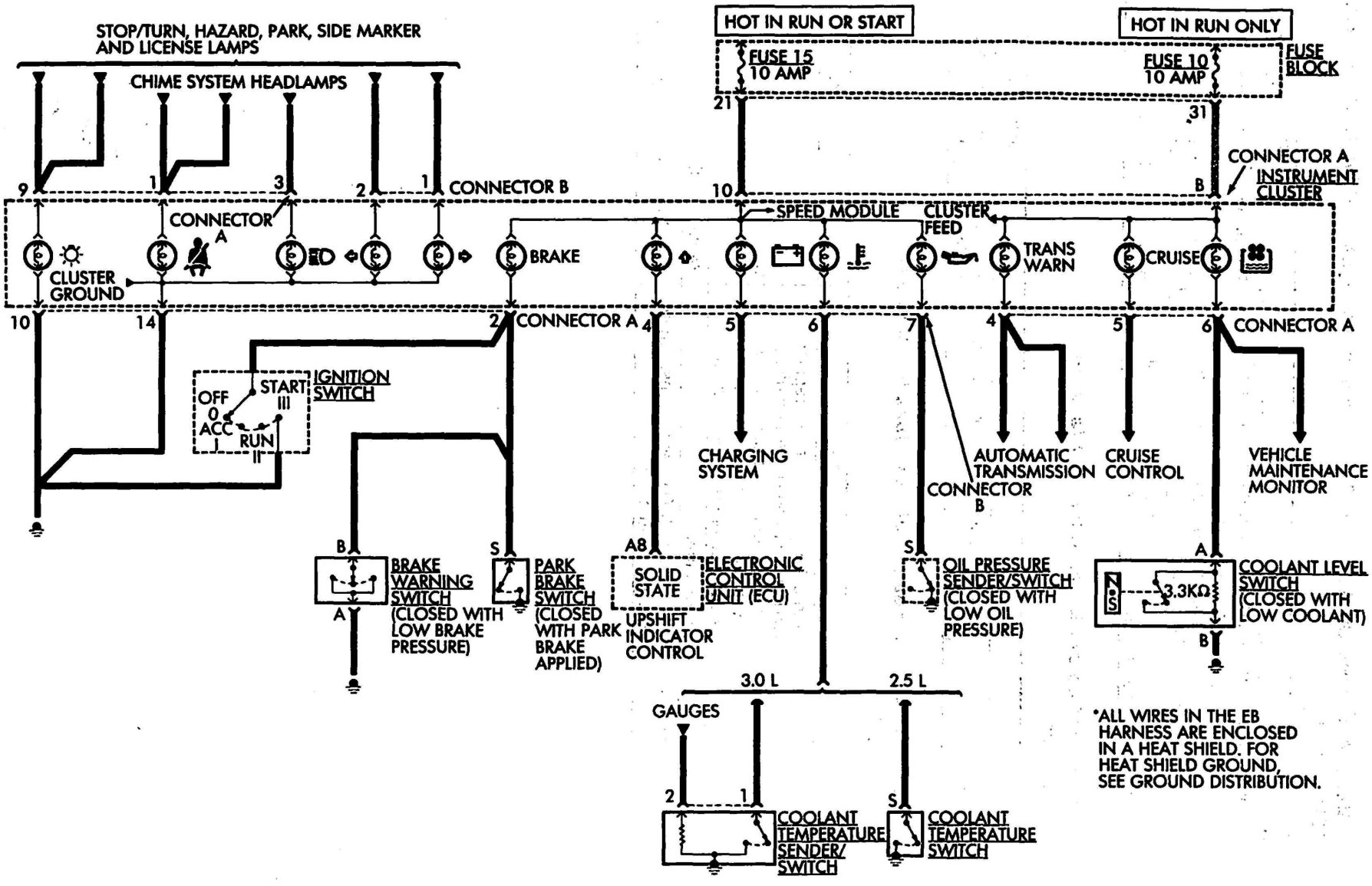


Fig. 3—Warning Indicators Schematic

VEHICLE MAINTENANCE MONITOR (VMM)

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General Information	9
Self-Diagnostics	9
Diagnosis	12

GENERAL INFORMATION

Fuse 2 applies voltage to the vehicle maintenance monitor at all times. This allows the monitor to remember the vehicle's present status when ignition is OFF. Fuse 8 applies voltage to the vehicle maintenance monitor to turn on the LCD display and begin monitoring the inputs to obtain information.

The conditions monitored are the oil level, coolant level, windshield washer fluid level, the vehicle speed and the door ajar inputs. The monitor also receives signals from the transmission control unit and the lamp outage module. If the vehicle is started and no faults are present, "monitor" will be displayed. Otherwise one of the 9 monitored system messages or one of the 6 service reminder messages is displayed. If the VMM detects more than one fault, it will list the highest priority message first. It will then cycle through a list of all existing faults, and return to the abbreviated message for the highest priority fault. All available VMM messages and their abbreviations are listed in order of priority as follows:

Door Ajar (DOOR) -

The appropriate door(s) is illuminated on the vehicle outline. Close door(s) to reset.

Brake Lamp Out (LAMP) -

Is activated when the brakes are applied and a bulb is burned out. To reset, replace bulb.

Tail Lamp Out (LAMP) -

Is activated when the tail lamps are on and a bulb is burned out. To reset, replace bulb.

Coolant Fluid Low (COOLANT) -

Add engine coolant as required to reset.

Oil Low (OIL) -

Oil level is monitored 12 minutes after the ignition is turned OFF. After 3 consecutive detections of low oil, the message will be displayed. After adding oil, the display may be reset by pressing RESET button while the oil level message is displayed and holding the button until the beep is heard. The display will automatically reset after the VMM sees 3 correct oil level readings. It is important to remember that the vehicle must be turned OFF for 12 minutes to check oil level and the vehicle should be at operating temperature when it is turned off. This must happen 3 times consecutively to reset the display.

Washer Fluid Low (WASHER) -

Add windshield washer fluid as required to reset.

Service Transmission (TRANS) -

Indicates fault in the automatic transmission of 4 cylinder vehicles.

Perform Service (SERVICE) -

Is activated at 7,500 miles (12 ooo kms) intervals to indicate that regular service and maintenance is due. Perform required service then press RESET button until the sound of the beep to clear the display.

Oil Sensor Fault (SENSOR) -

See diagnostics.

Coolant Sensor Fault (SENSOR) -

See diagnostics.

Washer Sensor Fault (SENSOR) -

See diagnostics.

Miles (KMS) To Service -

Indicates distance to the next scheduled service.

When a fault condition is present, the monitor also sends a signal to the chime module.

The vehicle maintenance monitor uses the vehicle speed input to calculate the distance traveled. It automatically notifies the driver, after a pre-programmed number of miles has elapsed, to perform a particular service on the vehicle.

When the lamps are on, the vehicle maintenance monitor display intensity is adjustable by using the panel dimmer switch. The monitor receives a signal from the English/Metric switch to display either English or Metric measurements.

The vehicle maintenance monitor also has a self-diagnostics. The vehicle maintenance monitor checks the monitor, the sensors and their circuits without the use of any special tools.

SELF-DIAGNOSTICS

To enter the diagnostics mode, simultaneously press and hold the CHECK and LIST switches then turn the ignition switch to RUN. With these switches pressed, move the ignition key to the ON position. The diagnostic program will start and loop continuously. To exit the diagnostic mode, simultaneously press the CHECK and LIST switches.

TEST 1 Initially, a number will be displayed on the monitor's screen. This number indicates the version of the maintenance module installed in the vehicle.

TEST 2

IN DISPLAY	MEANING
"CAL 0"	Monitor Bad
"CAL 1-7"	Monitor OK
"CAL F"	Monitor Bad

TEST 3 Displays Vehicle Option Content

IN DISPLAY	MEANING
OPT OCW	Has Oil, Coolant, Washer Level Sensing
OPT OC —	Has Oil, and Coolant Level Sensing
OPT O — —	Has Oil Level Sensing
OPT — CW	Has Coolant and Washer Level Sensing
OPT — — W	Has Washer Level Sensing
OPT — C —	Has Coolant Level Sensing
OPT O — W	Has Oil and Washer Level Sensing
OPT — — —	Has No Fluid Level Sensing Opt.

TEST 4 The module internal memory is tested.

IN DISPLAY	MEANING
"RAM P"	Monitor OK
"RAM F"	Monitor Bad

TEST 5 The module program is tested.

IN DISPLAY	MEANING
"ROM P"	Monitor OK
"ROM F"	Monitor Bad

TEST 6 The monitor's clocks are tested.

IN DISPLAY	MEANING
"TIME P"	Monitor OK
"TIME F"	Monitor Bad

TEST 7 The monitor's storage capability is tested.

IN DISPLAY	MEANING
"NVM P"	Monitor OK
"NVM F"	Monitor Bad

TEST 8 The monitor's internal synchronization is tested.

IN DISPLAY	MEANING
"PAR O"	Monitor OK
"PAR N"	Monitor Bad

TEST 9 The monitor's display screen is tested.

IN DISPLAY	MEANING
All Segments ON	Monitor OK
All Segments OFF	Monitor OK
"0"	Monitor OK
"1"	Monitor OK
"10"	Monitor OK
"100"	Monitor OK
"1000"	Monitor OK
"10000"	Monitor OK
"100000"	Monitor OK
"111111"	Monitor OK
"122222"	Monitor OK
"133333"	Monitor OK
"144444"	Monitor OK
"155555"	Monitor OK
"166666"	Monitor OK
"177777"	Monitor OK
"188888"	Monitor OK
"199999"	Monitor OK

The graphic segments will light, one at a time, in the following order, the engine symbol, the car outline, right front door, right rear door, rear tail lamps, left rear door, and left front door. Any deviation from the above patterns signifies a bad monitor. Should any of the segments fail to light, the monitor is bad.

908E-67

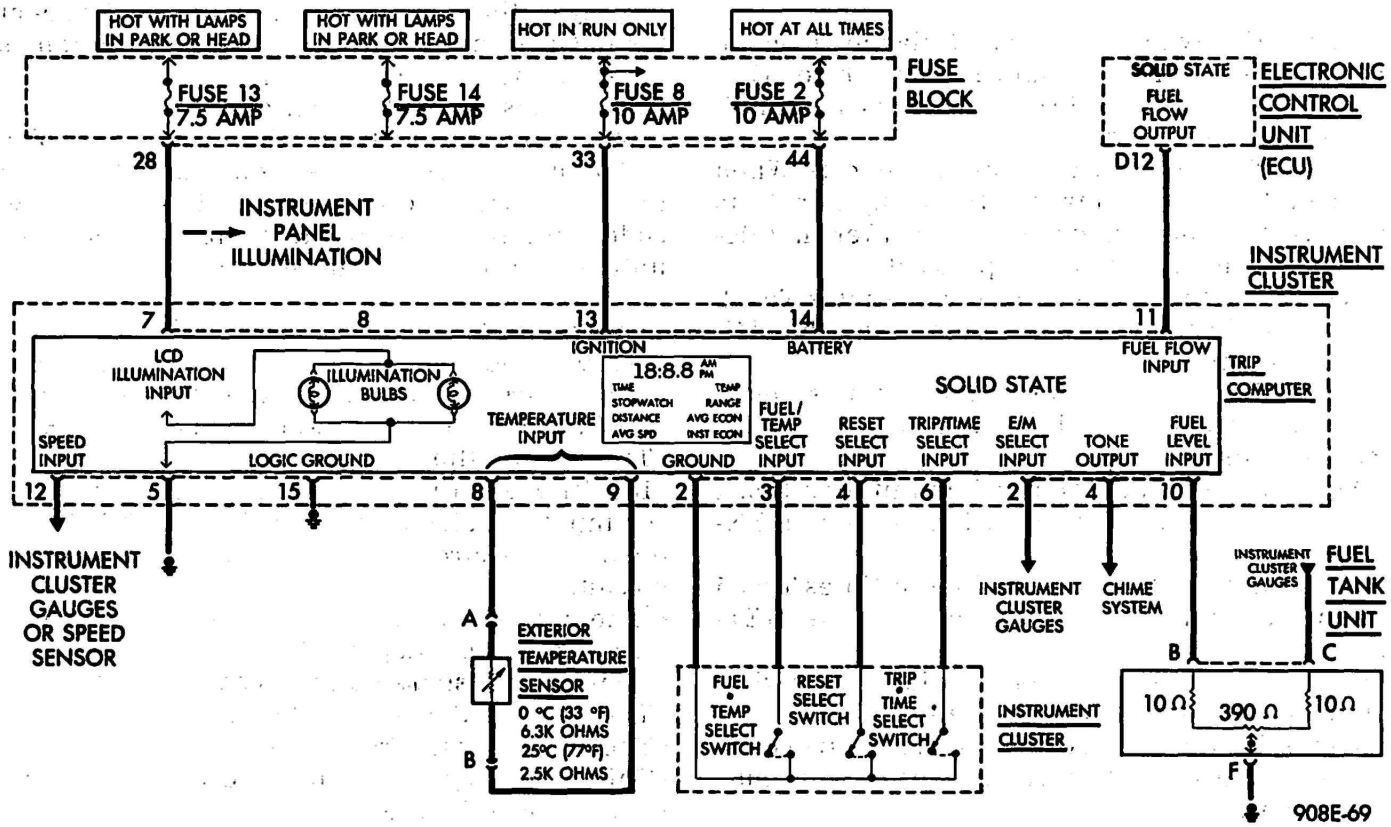


Fig. 1—Trip Computer Schematic

SELF-DIAGNOSTICS

The only way to enter the self-diagnostic mode is done by turning the ignition switch to RUN while the trip/time and reset switches are simultaneously depressed.

The self-diagnostics consists of five tests. When the self-diagnostics start, the trip computer starts with Test 1. The sequence of tests after that depends on which switch is depressed.

- Depressing the trip/time switch initiates Test 2 when the English/Metric switch is in the ENGLISH position.
- Depressing the trip/time switch initiates Test 3 when the English/Metric switch is in the METRIC position.
- Depressing the fuel/temp switch initiates Test 4 when the English/Metric switch is in the ENGLISH position.
- Depressing the fuel/temp switch initiates Test 5 when the English/Metric switch is in the METRIC position.
- Switching the key off exits self-diagnostics without resetting any fault conditions.
- Depressing the reset switch returns the trip computer to the time display and resets any fault conditions.

Test 1

The trip computer displays the vehicle tank size and software revision level (there are three revision levels). The chart below lists codes that will be displayed for various tank sizes. The Premier, 17 gallon tank is represented by tank code number 4.

Tank Code Number	Capacity (Gallons)
00	20.2
1	16
2	13.5
3	23.5
4	18-Version 2
	17-Version 3

With version 2 software, every segment in the display is illuminated and extinguished. Segment testing continues until the trip/time button is pressed, the fuel/temp button is pressed, or the self-diagnostics mode is exited.

With version 3 software the previous display test is not performed. Version 3 maintains the display of software revision level and tank size code until trip/time or fuel/temp is pressed or until exit from self-diagnostics.

Tests 2 and 3

Tests 2 and 3 check the circuit of the exterior temperature sensor and the speed input circuit.

TEST 2 (English Metric switch set on ENGLISH)

- The Temp telltale lights.
- If a failure of the ambient air temperature sensor input is detected the display is "CO" for an open in the circuit, or "CS" for a short in the circuit.
- If no failure is detected, the instantaneous temperature will be displayed.

TEST 3 (English Metric switch set on METRIC)

- The Average Speed telltale lights.
- The speed sensor frequency is displayed.
- This frequency begins at 0 and increase as the vehicle speed increases.

Tests 4 and 5

Tests 4 and 5 check the fuel level circuit and fuel flow circuit.

TEST 4 (English Metric switch set on ENGLISH)

- The Range telltale lights.
- If a failure of the fuel level sensor input is detected the display is "CO" for an open in the circuit, or "CS" if there is a short in the circuit.
- If no failures are detected, the fuel level will be displayed in liters.

TEST 5 (English/Metric switch set on METRIC)

- The Instant Economy telltale lights.
- If a failure of the flow input is detected the display will be "CO"
- If a failure is not detected, the frequency of the fuel flow sensor will be displayed. This frequency will vary as the fuel consumption varies.

SELF-DIAGNOSTICS

The only way to enter the self-diagnostic mode is done by turning the ignition switch to RUN while the trip/time and reset switches are simultaneously depressed.

The self-diagnostics consists of five tests. When the self-diagnostics start, the trip computer starts with Test 1. The sequence of tests after that depends on which switch is depressed.

- Depressing the trip/time switch initiates Test 2 when the English/Metric switch is in the ENGLISH position.
- Depressing the trip/time switch initiates Test 3 when the English/Metric switch is in the METRIC position.
- Depressing the fuel/temp switch initiates Test 4 when the English/Metric switch is in the ENGLISH position.
- Depressing the fuel/temp switch initiates Test 5 when the English/Metric switch is in the METRIC position.
- Switching the key off exits self-diagnostics without resetting any fault conditions.
- Depressing the reset switch returns the trip computer to the time display and resets any fault conditions.

Test 1

The trip computer displays software revision level (there are three revision levels). Then the fuel tank size. The chart below lists codes that will be displayed for various tank sizes. The Premier, 17 gallon tank is represented by tank code number 4.

Tank Code Number	Capacity (Gallons)
00	20.2
1	16
2	13.5
3	23.5
4	18-Version 2
	17-Version 3

NOTE: If the trip computer displays an ERR during test 1, replace the trip computer.

With version 2 software, every segment in the display is illuminated and extinguished. Segment testing continues until the trip/time button is pressed, the fuel/temp button is pressed, or the self-diagnostics mode is exited.

With version 3 software the previous display test is not performed. Version 3 maintains the display of software revision level and tank size code until trip/time or fuel/temp is pressed or until exit from self-diagnostics.

Tests 2 and 3

Tests 2 and 3 check the circuit of the exterior temperature sensor and the speed input circuit.

TEST 2 (English Metric switch set on ENGLISH)

- The Temp telltale lights.
- If a failure of the ambient air temperature sensor input is detected the display is "CO" for an open in the circuit, or "CS" for a short in the circuit.
- If no failure is detected, the instantaneous temperature will be displayed.

TEST 3 (English Metric switch set on METRIC)

- The Average Speed telltale lights.
- The speed sensor frequency is displayed.
- This frequency begins at 0 and increase as the vehicle speed increases.

Tests 4 and 5

Tests 4 and 5 check the fuel level circuit and fuel flow circuit.

TEST 4 (English Metric switch set on ENGLISH)

- The Range telltale lights.
- If a failure of the fuel level sensor input is detected the display is "CO" for an open in the circuit, or "CS" if there is a short in the circuit.
- If no failures are detected, the fuel level will be displayed in liters.

TEST 5 (English/Metric switch set on METRIC)

- The Instant Economy telltale lights.
- If a failure of the flow input is detected the display will be "CO"
- If a failure is not detected, the frequency of the fuel flow sensor will be displayed. This frequency will vary as the fuel consumption varies.

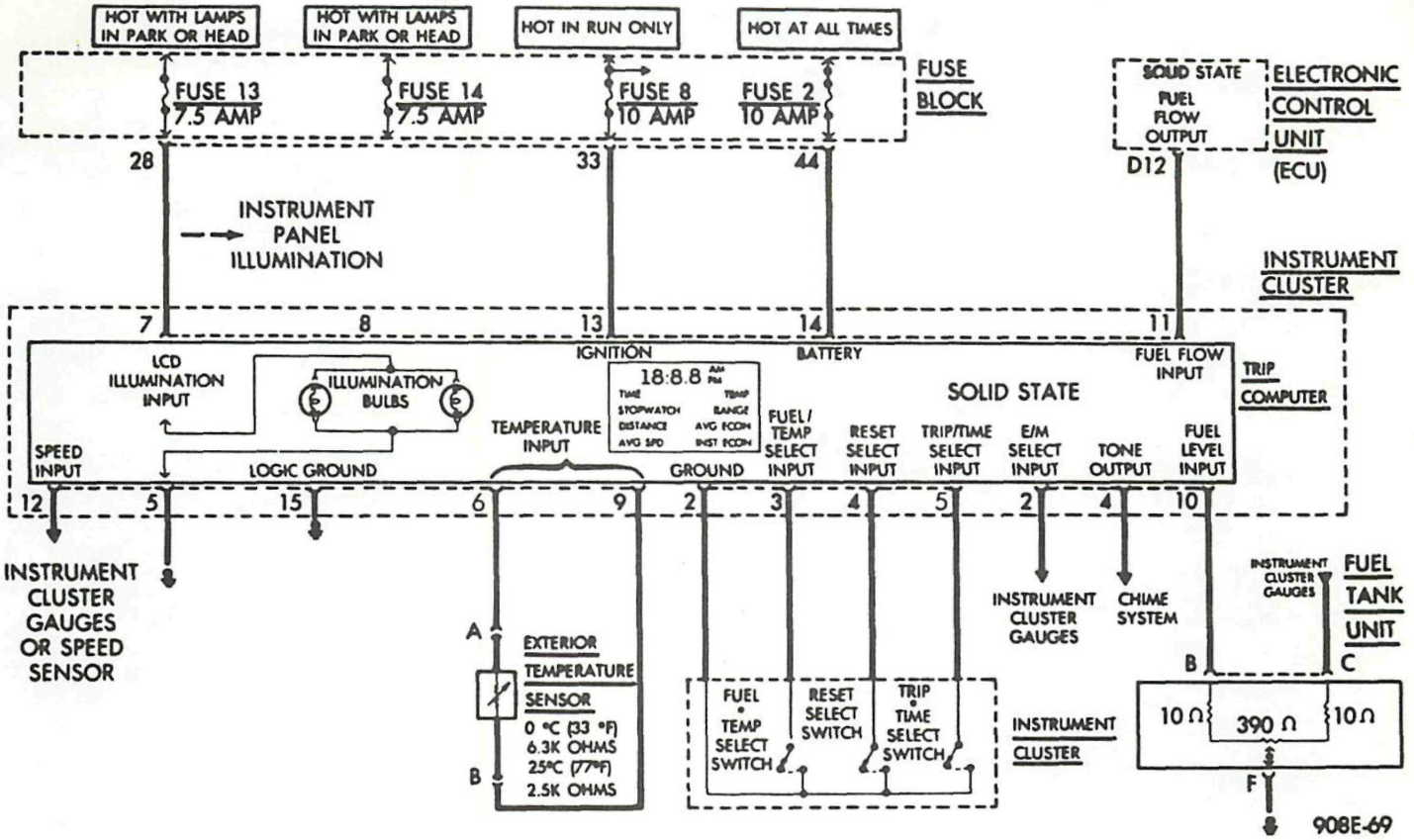


Fig. 1—Trip Computer Schematic

TRIP COMPUTER

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GENERAL INFORMATION

Fuse 2 applies voltage to the trip computer at all times. This voltage enables the trip computer to remember the pertinent information when the ignition is OFF. It also provides power to keep the clock operating. Fuse 8 applies voltage to the trip computer when the motor is in RUN. It signals the trip computer to enable the display and begin monitoring its inputs.

The trip computer monitors the following circuits: vehicle speed, fuel level, fuel flow, and outside temperature. Fuel and vehicle speed inputs are used to calculate fuel economy and average speed and range.

The incandescent illumination bulbs are ON with the key in RUN. When the park lamps or headlamps are turned ON, the dimming of the lamps is put in the control of the instrument panel rheostat.

The switches in the instrument cluster control the trip computer and tell it what to display. When a switch is pressed, ground is applied to the corresponding input.

The tone output is connected to the chime module. When the trip computer changes displays, the chime module chimes.

The trip computer also has self-diagnostics. It can perform five tests. These tests can help on troubleshooting the sensors and their circuits.

DIAGNOSIS (Fig. 1)

No Display Or Incorrect Information

Ignition Switch In RUN

TEST	OK	NOT OK
Inspect Fuses 8 and 19 (Without Passive Restraint)/Fuse 2 (With Restraint)	Not blown	Replace fuse(s)
Trip Computer connector - Terminal 15 (key OFF)	Zero ohms	Repair open to ground
Trip Computer connector - Terminals 13 and 14 (key ON)	Battery voltage if there is no display and lamps on, replace the trip computer. If there is incorrect information, perform the self-diagnostic test	Repair open to fuse block
Perform Self-Diagnostics	As described in Self-Diagnostics	Replace sensor or trip computer as indicated

Trip Computer Illumination Does Not Operate

Refer To Instrument Panel Illumination

Trip Computer Does Not Change Mode

Disconnect Trip Computer Connector B

TEST	OK	NOT OK
Connector B - Terminal 2 to 3 with fuel temp select switch depressed	Zero ohms	Replace mode select switches
Connector B - Terminal 2 to 4 with reset select switch depressed	Zero ohms	Replace mode select switches
Connector B - Terminal 2 to 5 with trip/time switch depressed	Zero ohms	Replace mode select switches

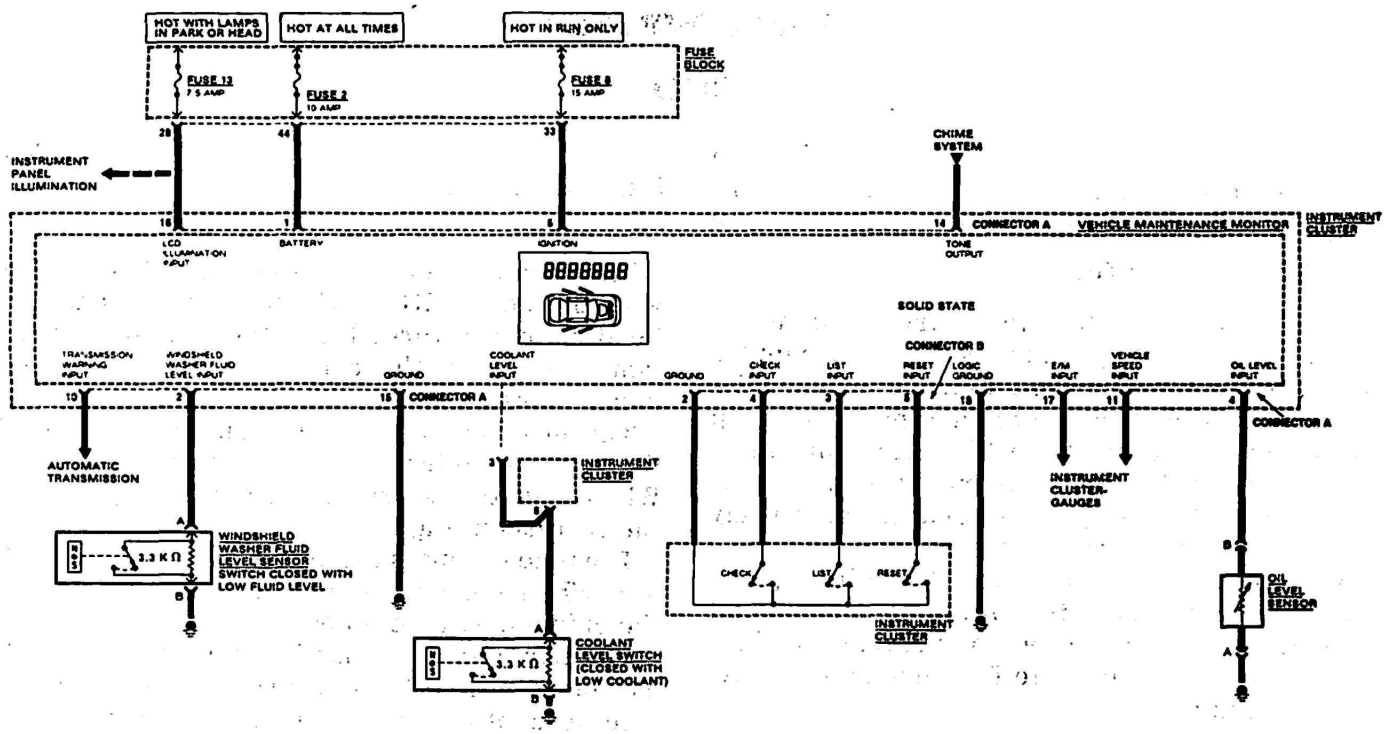


Fig. 1—Vehicle Maintenance Monitor Schematic

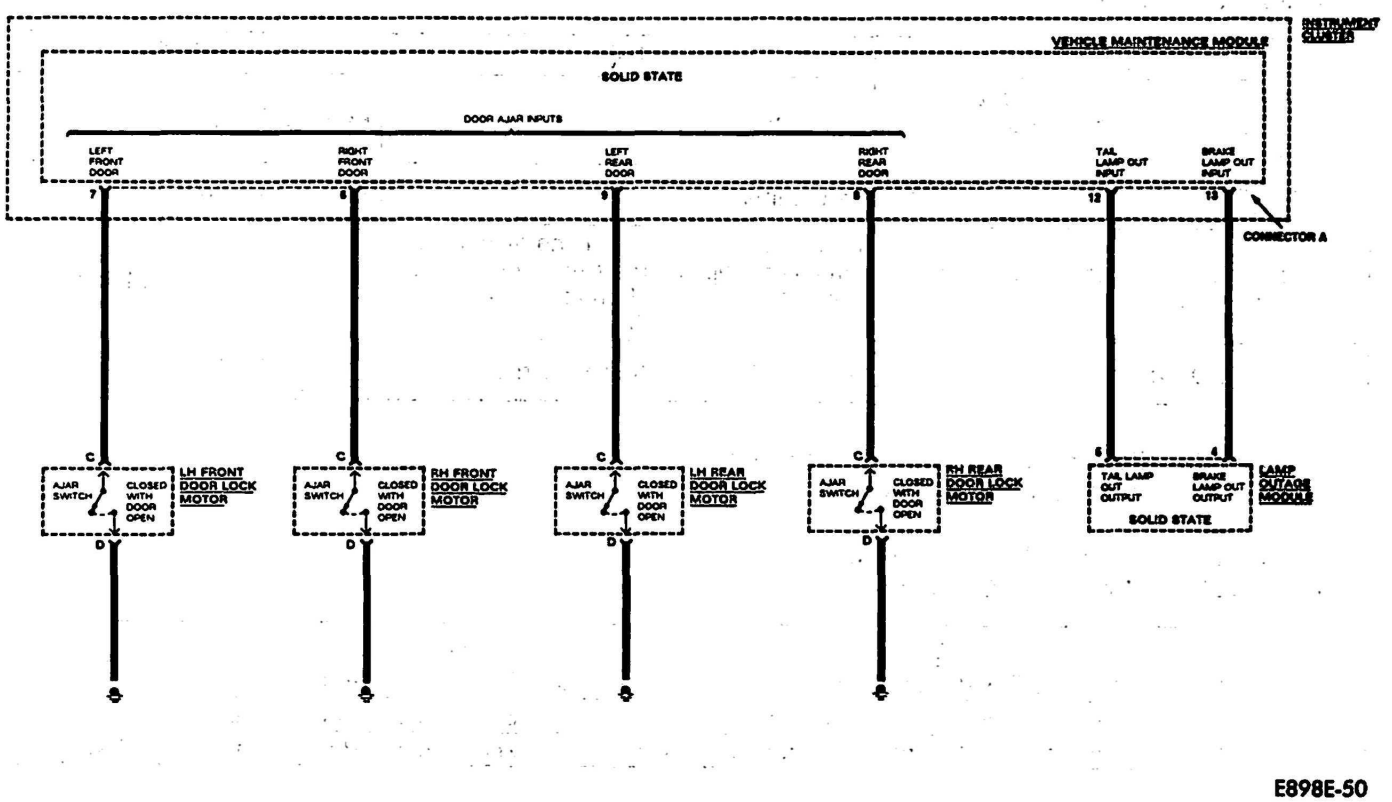


Fig. 2—Vehicle Maintenance Monitor Schematic

There are two modes for the diagnostic program: automatic and manual. In the automatic mode, the program will automatically perform all the tests in sequence. The sequence of tests will repeat until the diagnostic routine is exited. In the manual mode, each test will be performed individually and will only progress to the next test when the CHECK switch is pressed. Modes can be changed by pressing the English/Metric switch. If the instrument cluster is in the English mode, the program is in the automatic mode. If in the Metric mode, the program is in the manual mode.

The following is a list of individual tests that are performed and the messages that are displayed on the Vehicle Maintenance Monitor's screen representing the outcome of the test.

DIAGNOSIS (Figs. 1, 2)

No Display or Incorrect Information

Ignition In RUN And Engine Running

TEST	OK	NOT OK
Inspect Fuse 8 and 19 (Without Passive Restraint System) 2 (Restraint System)	Not blown	Replace blown fuse
Connector A - Terminals 1 and 5	Battery voltage	Repair open to fuse block
Connector A - Terminals 15 and 18	Zero ohms if there is no display, replace the vehicle maintenance monitor. If there is incorrect information, perform the self-diagnostic test	Repair open to ground
Connector A - Terminals 6, 7, 8 and 9	Infinite ohms with doors closed	Check circuit for a short to ground

Vehicle Maintenance Monitor Illumination Does Not Operate

Refer to Instrument Panel Illumination

Vehicle Maintenance Monitor Does Not Change Mode

Disconnect connector B

TEST	OK	NOT OK
Connector B - Terminal 2 and 4 with CHECK select switch depressed	Zero ohms	Replace mode select switches
Connector B - Terminal 2 to 3 with LIST select switch depressed	Zero ohms	Replace mode select switches
Connector B - Terminal 2 to 5 with RESET switch depressed	Zero ohms	Replace mode select switches

TEST 10 This test can only be performed while the test program is in the manual mode. OIL will flash. Release CHECK button and press and hold LIST button until OIL flashes three times, then release LIST button and OIL will stop flashing. There will be a 30-45 second delay while system is testing, Oil level faults are displayed at this time. The engine oil level is tested.

IN DISPLAY	MEANING
"OIL H"	Monitor OK, Oil Level Normal
"OIL L"	Monitor OK, but Oil Level Is Low
"OIL O"	Monitor OK, but Oil Level Sensor Is Open
"OIL S"	Monitor OK, but Oil Level Sensor Is Shorted

TEST 11 The oil level probe is tested. The intermittent fault can be cleared in diagnostic program by pressing RESET switch while message is displayed.

IN DISPLAY	MEANING
"OIL IF"	Intermittent Fault With Oil Sensor
NO MESSAGE	Monitor OK, Sensor OK

TEST 12 The washer fluid level is tested.

IN DISPLAY	MEANING
"WASH H"	Washer Fluid Level Normal
"WASH L"	Washer Fluid Level Low
"WASH O"	Washer Fluid Level Probe Open

TEST 13 The washer level sensor is tested. The intermittent fault can be cleared in diagnostic program by pressing RESET switch while message is displayed.

IN DISPLAY	MEANING
"WASHER IF"	Intermittent Fault With Washer Fluid Sensor
"NO MESSAGE"	Monitor OK, Sensor OK

TEST 14 The coolant fluid level is tested.

IN DISPLAY	MEANING
"COOL H"	Coolant Fluid Level Is Normal
"COOL L"	Coolant Fluid Level Is Low
"COOL O"	Coolant Fluid Level Probe Is Open

TEST 15 The coolant fluid level sensor is tested. The intermittent fault can be cleared in diagnostic program by pressing RESET switch while message is displayed.

IN DISPLAY	MEANING
"COOL IF"	Intermittent Fault With the Coolant Level Sensor
"NO MESSAGE"	Monitor OK, Sensor OK

TEST 16 The tail lamp circuit is tested.

IN DISPLAY	MEANING
"TLO P"	Tail Lamp Circuit OK
"TLO F"	Tail Lamp Circuit Open

TEST 17 The brake lamp circuit is tested.

IN DISPLAY	MEANING
"BLO P"	Brake Lamp Circuit OK
"BLO F"	Brake Lamp Circuit Open

TEST 18 The status of the transmission diagnostic module is tested.

IN DISPLAY	MEANING
"TRANS P"	Transmission Module OK
"TRANS F"	Transmission Module Fault

TEST 19 The frequency of the road speed sensor is displayed. When in manual mode, continuous monitoring is possible.

IN DISPLAY	MEANING
"SPD XXX"	Frequency of Vehicle Speed Sensor

*Note: XXX will vary from 0 and increase as vehicle speed increases.

There are two modes for the diagnostic program: automatic and manual. In the automatic mode, the program will automatically perform tests in sequence. The sequence of tests will repeat until the diagnostic routine is exited. In the manual mode, each test will be performed individually and will only progress to the next test when the CHECK switch is pressed. Modes can be changed by pressing the English/Metric switch. If the instrument cluster is in the English mode, the program is in the automatic mode. If in the Metric mode, the program is in the manual mode.

The following is a list of individaul test that are performed and the messages that are displayed on the Vehicle Maintenance Monitor's screen representing the outcome of the test.

NOTE: To reset on intermittent fault. (I.F.) Progress through the test sequence in the MANUAL mode until the fault is displayed. Then press the reset button.

DIAGNOSIS (Figs. 1, 2)

No Display or Incorrect Information

Ignition In RUN And Engine Running

TEST	OK	NOT OK
Inspect Fuse 8 and 19 (Without Passive Restraint System) 2 (Restraint System)	Not blown	Replace blown fuse
Connector A - Terminals 1 and 5	Battery voltage	Repair open to fuse block
Connector A - Terminals 15 and 18	Zero ohms if there is no display, replace the vehicle maintenance monitor. If there is incorrect information, perform the self-diagnostic test	Repair open to ground
Connector A - Terminals 6, 7, 8 and 9	Infinite ohms with doors closed	Check circuit for a short to ground

Vehicle Maintenance Monitor Illumination Does Not Operate

Refer to Instrument Panel Illumination

Vehicle Maintenance Monitor Does Not Change Mode

Disconnect connector B

TEST	OK	NOT OK
Connector B - Terminal 2 and 4 with CHECK select switch depressed	Zero ohms	Replace mode select switches
Connector B - Terminal 2 to 3 with LIST select switch depressed	Zero ohms	Replace mode select switches
Connector B - Terminal 2 to 5 with RESET switch depressed	Zero ohms	Replace mode select switches

TEST 10 The washer fluid level is tested.

IN DISPLAY	MEANING
"WASH H"	Washer Fluid Level Normal
"WASH L"	Washer Fluid Level Low
"WASH O"	Washer Fluid Level Probe Open

TEST 11 The washer level sensor is tested. The intermittent fault can be cleared in diagnostic program by pressing RESET switch while message is displayed.

IN DISPLAY	MEANING
"WASHER IF"	Intermittent Fault With Washer Fluid Sensor
"NO MESSAGE"	Monitor OK, Sensor OK

TEST 12 The coolant fluid level is tested.

IN DISPLAY	MEANING
"COOL H"	Coolant Fluid Level Is Normal
"COOL L"	Coolant Fluid Level Is Low
"COOL O"	Coolant Fluid Level Probe Is Open

TEST 13 The coolant fluid level sensor is tested. The intermittent fault can be cleared in diagnostic program by pressing RESET switch while message is displayed (manual mode only).

IN DISPLAY	MEANING
"COOL IF"	Intermittent Fault With the Coolant Level Sensor
"NO MESSAGE"	Monitor OK, Sensor OK

TEST 14 The tail lamp circuit is tested.

IN DISPLAY	MEANING
"TLO P"	Tail Lamp Circuit OK
"TLO F"	Tail Lamp Circuit Shorted

TEST 15 The brake lamp circuit is tested.

IN DISPLAY	MEANING
"BLO P"	Brake Lamp Circuit OK
"BLO F"	Brake Lamp Circuit Shorted

TEST 16 The status of the transmission diagnostic module is tested.

IN DISPLAY	MEANING
"TRANS P"	Transmission Module OK
"TRANS F"	Transmission Module Fault

TEST 17 The frequency of the road speed sensor is displayed. When in manual mode, continuous monitoring is possible.

IN DISPLAY	MEANING
"SPD XXX"	Frequency of Vehicle Speed Sensor

*Note: XXX will vary from 0 and increase as vehicle speed increases.

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Publication #81-270-0140
TSB #08-08-90
March 26, 1990

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Publication #81-270-0140

TEST 1 Initially, a revision number will be displayed on the monitor's screen. This number indicates the version of the maintenance module installed in the vehicle.

TEST 2

IN DISPLAY	MEANING
"CAL 0"	Monitor Bad
"CAL 1-7"	Monitor OK
"CAL F"	Monitor Bad

TEST 3 Displays Vehicle Option Content

IN DISPLAY	MEANING
OPT OCW	Has Oil, Coolant, Washer Level Sensing
OPT OC —	Has Oil, and Coolant Level Sensing
OPT O — —	Has Oil Level Sensing
OPT — CW	Has Coolant and Washer Level Sensing
OPT — — W	Has Washer Level Sensing
OPT — C —	Has Coolant Level Sensing
OPT O — W	Has Oil and Washer Level Sensing
OPT — — —	Has No Fluid Level Sensing Opt.

TEST 4 The module internal memory is tested.

IN DISPLAY	MEANING
"RAM P"	Monitor OK
"RAM F"	Monitor Bad

TEST 5 The module program is tested.

IN DISPLAY	MEANING
"ROM P"	Monitor OK
"ROM F"	Monitor Bad

TEST 6 The monitor's clocks are tested.

IN DISPLAY	MEANING
"TIME P"	Monitor OK
"TIME F"	Monitor Bad

TEST 7 The monitor's storage capability is tested (manual mode only).

IN DISPLAY	MEANING
"NVM P"	Monitor OK
"NVM F"	Monitor Bad

TEST 8 The monitor's internal synchronization is tested.

IN DISPLAY	MEANING
"PAR O"	Monitor OK
"PAR N"①	Monitor Bad

① N = any number other than 0

TEST 9 The monitor's display screen is tested.

IN DISPLAY	MEANING
All Segments ON	Monitor OK
All Segments OFF	Monitor OK
"0"	Monitor OK
"1"	Monitor OK
"10"	Monitor OK
"100"	Monitor OK
"1000"	Monitor OK
"10000"	Monitor OK
"100000"	Monitor OK
"111111"	Monitor OK
"122222"	Monitor OK
"133333"	Monitor OK
"144444"	Monitor OK
"155555"	Monitor OK
"166666"	Monitor OK
"177777"	Monitor OK
"188888"	Monitor OK
"199999"	Monitor OK

The graphic segments will light, one at a time, in the following order, the engine symbol, the car outline, right front door, right rear door, rear tail lamps, left rear door, and left front door. Any deviation from the above patterns signifies a bad monitor. Should any of the segments fail to light, the monitor is bad.

908E-67

TSB #08-08-90
March 26, 1990

INSTRUMENT PANEL ILLUMINATION

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GENERAL INFORMATION

With the headlamps or park lamps on, battery voltage from the lamp module is applied to the panel dimmer switch in the left hand module. As the driver adjusts the instrument panel illumination brightness, the resistance of the panel dimmer switch changes. The lamp module senses the change in resistance and determines the amount of voltage to apply to fuse 13 and fuse 14 to control illumination brightness.

Voltage for instrument panel illumination comes from fuse 13 and fuse 14. Fuse 14 supplies voltage to the incandescent lamps in the analog cluster gauges. Fuse 13 supplies voltage to the incandescent lamps in the LCD modules. When the ignition switch is in ACC or RUN, voltage is applied to the radio lamp relay and the radio or graphic equalizer from fuse 5. When the ignition switch is in RUN, fuse 8 supplies voltage to the radio lamp relay. The relay energizes and supplies voltage from fuse 13 to the radio for controlled illumination.

DIAGNOSIS (Fig. 1)

No Instrument Panel Illumination

Head Lamp Switch In Park or Head

TEST	OK	NOT OK
Left Hand Module connector - Terminal R	Battery voltage	Refer to Group 8L
Left Hand Module connector - Terminal P Panel Dimmer switch in DIM position	Battery voltage	Replace left hand module
Left Hand Module connector - Terminal S Panel Dimmer switch in BRIGHT position	Battery voltage	Replace left hand module
Lamp Module connector - Terminal D10 Panel Dimmer switch in DIM position	1.7 Volts	Repair open to left hand module
Lamp Module connector - Terminal C9 Panel Dimmer switch in BRIGHT position	3.7 Volts	Repair open to left hand module
Terminal D16	Battery voltage	Repair harness or fuse for open
Lamp Module connector - Terminal D7 and D8	Battery voltage	Replace lamp module
Fuse Block - Terminals 22 and 23	Battery voltage	Repair open to lamp module
Power supply wires to components	Battery voltage	Repair open to fuse 13, 14 or harness
Ground wires to components	Zero ohms	Repair open to ground

No Illumination In One Component

Headlamps or Park Lamps On and Panel Dimmer Switch In Bright Position

TEST	OK	NOT OK
Power supply wire to component or bulb	Battery voltage	Repair open to respective splice
Ground wire for component or bulb	Zero ohms	Repair open to ground splice

Radio Has No Illumination

Ignition Switch In RUN, Headlamps or Park Lamps On and Panel Dimmer Switch In Bright

TEST	OK	NOT OK
Inspect Fuse 8	Not blown	Replace Fuse 8
Radio Lamp Relay connector - Terminal 2	Battery voltage	Repair open to Fuse 8
Radio Lamp Relay connector - Terminal 1	Battery voltage	Repair open to Splice
Radio Lamp Relay connector - Terminal 5	Zero ohms	Repair open to ground
Radio Lamp Relay connector - Terminal 4	Battery voltage	Replace the radio lamp relay
Radio or Graphic Equalizer connector Terminals C and D	Battery voltage. If OK, replace radio or graphic equalizer	Repair open to radio lamp relay or splice

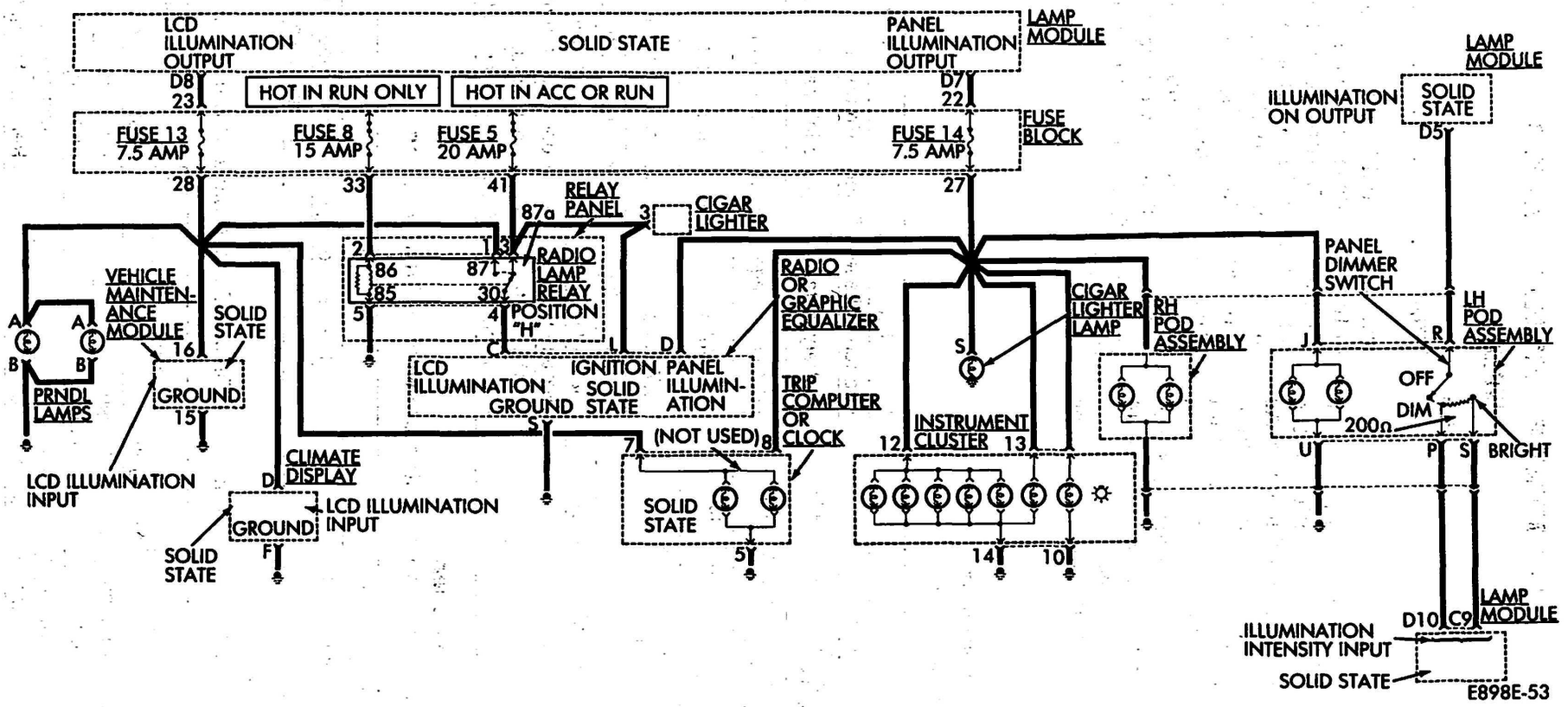


Fig. 1—Instrument Panel Illumination Schematic

INSTRUMENT CLUSTER COMPONENT SERVICING

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CLUSTER

Removal

(1) Remove the instrument cluster bezel (Fig. 1) by removing screws.
(2) Remove cluster retaining screws (Fig. 2).
(3) Tilt cluster forward and disconnect electrical connectors (Fig. 3).
(4) Remove cluster.

Installation

(1) Connect electrical connectors.
(2) Install cluster with screws (Fig. 3).
(3) Install bezel and secure with screws (Fig. 1).

CLUSTER DISASSEMBLY

Control Switch Panel

Removal

(1) Remove the cluster as described in Instrument Cluster Replacement.
(2) Remove screws (Fig. 4) from front of cluster.
(3) Remove screw (Fig. 5) from back of cluster.
(4) Remove control switch panel (time switches and warning light display) (Fig. 6).

Installation

(1) Guide switch wires through openings in cluster.
(2) Position switch panel and secure with screws.
(3) Install cluster as described in Instrument Cluster Installation.

Speedometer

Removal

(1) Remove the cluster as described in Instrument Cluster Removal.
(2) Remove control switch panel as described in Control Switch Panel Replacement.
(3) Remove clear lens.
(4) Remove screws (Fig. 8) and remove black mask.
(5) Remove screws and nuts (Fig. 9).
(6) Remove dial and gauge assembly (Fig. 10) from cluster housing.

CAUTION: Wear clean gloves when handling the cluster. Finger prints and finger nails will mar the surface.

(7) Grasp the pointer hub and slowly rotate the pointer assembly clockwise and counterclock-

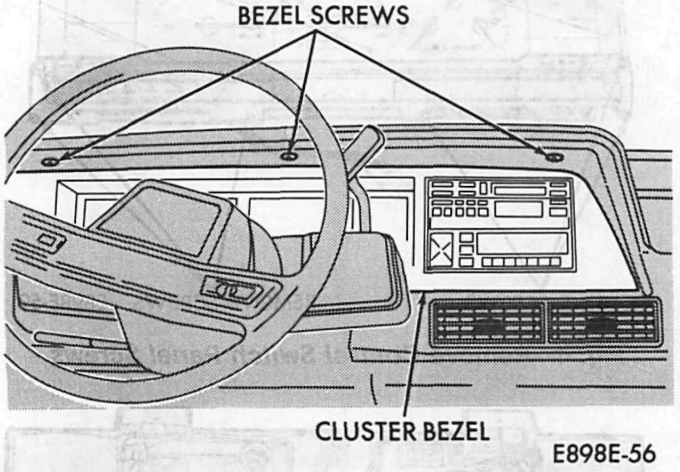


Fig. 1—Remove Cluster Bezel

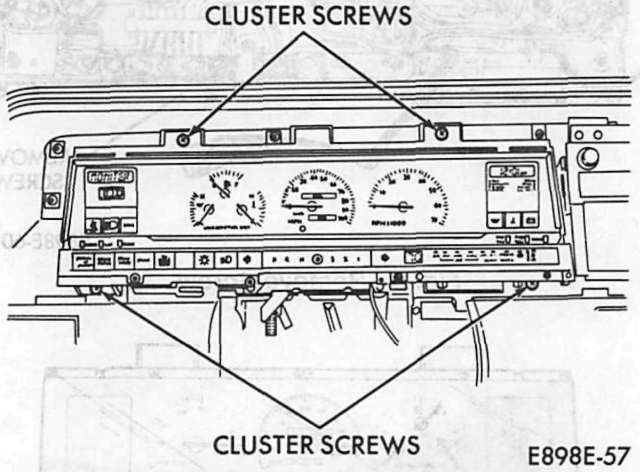


Fig. 2—Remove Cluster Retaining Screws

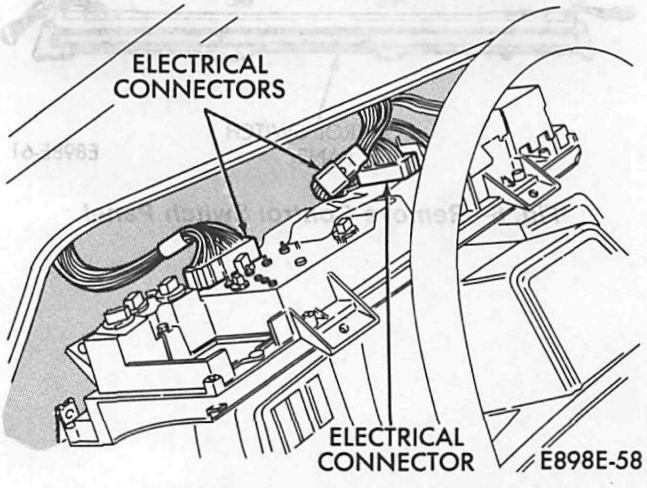


Fig. 3—Disconnect Electrical Connectors

wise until the pointer contacts the trip reset shaft, while gently pulling upward on the hub away from the dial surface. Repeat this procedure approximately 5-15 times, until the pointer assembly lifts off the movement shaft.

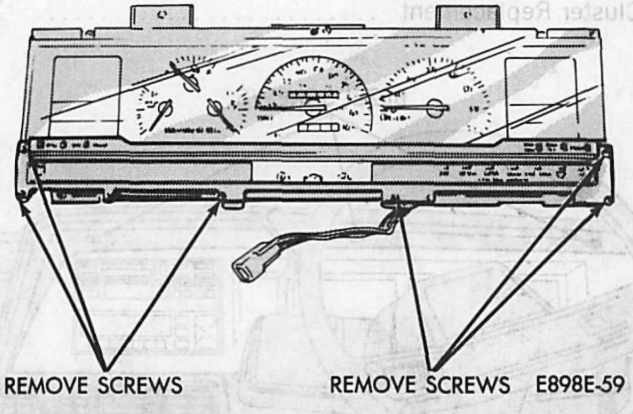


Fig. 4—Remove Control Switch Panel Screws

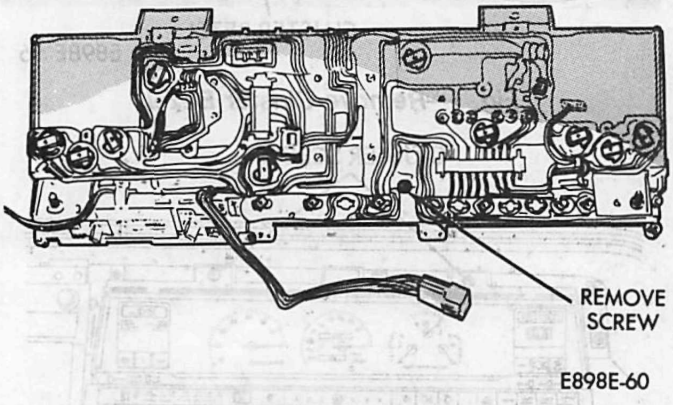


Fig. 5—Remove Screw

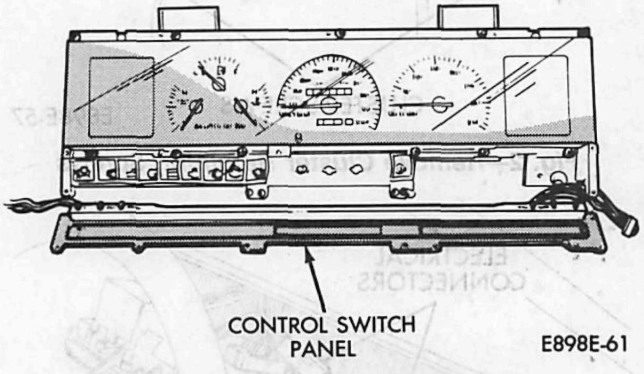


Fig. 6—Remove Control Switch Panel

(8) Remove screws (Fig. 11) and separate speedometer from face plate.

Installation

(1) Position speedometer and secure with screws (Fig. 11).

(2) Grasp the pointer by the hub and gently place the bushing onto the movement shaft. The pointer tip should be indicating approximately 90 MPH (140 Kph).

(3) Rotate the pointer assembly counterclockwise while gently pushing down on the hub toward the dial surface (slight resistance should be felt). Clearance between the hub underside and dial surface should be 0.5-1.5mm (0.020-0.060 inch) before the pointer tip is in line with the zero horizontal graduation.

(4) Stop when the pointer tip comes in line with the zero horizontal graduation.

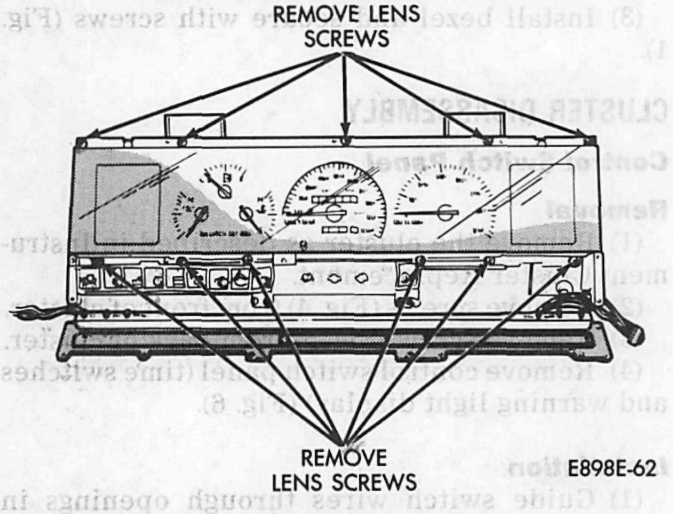


Fig. 7—Remove Clear Lens

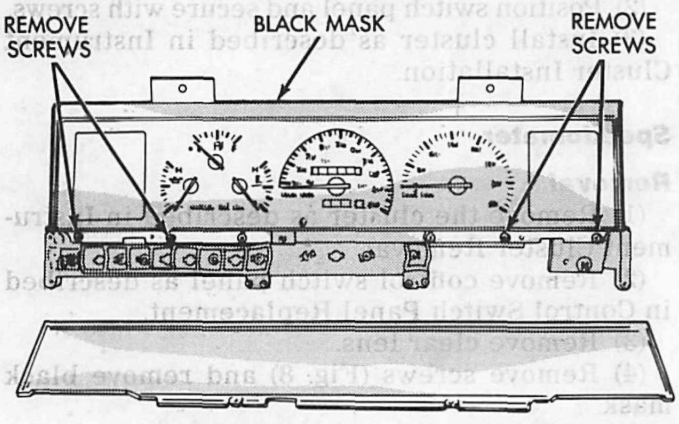


Fig. 8—Remove Black Mask

(5) If the pointer is NOT properly aligned to the horizontal graduation, perform either of the two following steps.

(a) Pointer too HIGH: Continue rotating assembly counterclockwise until alignment is achieved.

(b) Pointer too LOW: Rotate pointer assembly clockwise until rotational resistance is felt (does not refer to contact with trip reset shaft). Continue rotating in direction of resistance to compensate for initial misalignment. Release hub allowing pointer assembly to rotate back to its rest position.

(c) If alignment is not achieved, repeat steps (a) or (b) as required.

(6) Position gauge face plate and secure by installing nuts.

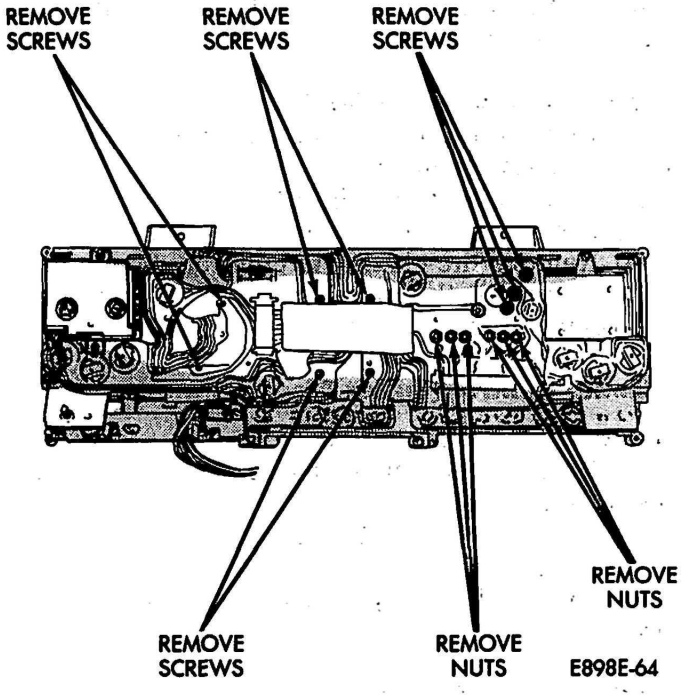


Fig. 9—Remove Screws and Nuts

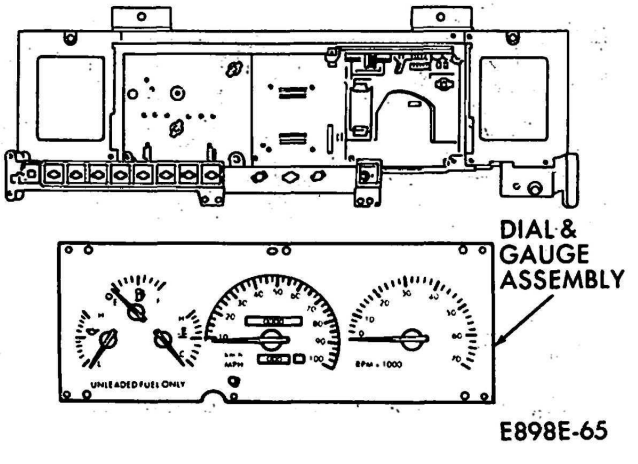


Fig. 10—Remove Dial and Gauge Assembly

(7) Install screws (Fig. 9).

(8) Position black mask.

(9) Position clear lens and secure with screws (Fig. 7, 8).

(10) Install front switch panel as described in Control Panel Replacement.

(11) Install the cluster as described in Instrument Cluster Replacement

Tachometer

Removal

(1) Remove the cluster as described in Instrument Cluster Removal.

(2) Remove control switch panel as described in Control Switch Panel Replacement.

(3) Remove clear lens.

(4) Remove screws (Fig. 8) and black mask.

(5) Remove screws and nuts (Fig. 9).

(6) Remove dial and gauge assembly (Fig. 10) from cluster housing.

CAUTION: Wear clean gloves when handling the cluster. Finger prints and finger nails will mar the surface.

(7) Grasp the pointer hub and slowly rotate the pointer assembly counterclockwise while gently pulling upward on the hub away from the dial surface. Approximately 5-15 revolutions are required for separation.

(8) Remove screws (Fig. 12) and separate tachometer from face plate.

Installation

(1) Position tachometer and secure with screws.

(2) Grasp the pointer by the hub and gently place the bushing onto the movement shaft. The pointer tip should be indicating approximately 6000 RPM.

(3) Rotate the pointer assembly counterclockwise while gently pushing down on the hub toward the dial surface (slight resistance should be felt). Clearance between the hub underside and the dial surface should be 0.5-1.5mm (0.020-0.060 inch) before the pointer tip is in line with the zero horizontal graduation.

(4) Stop when the pointer tip comes in line with the zero horizontal graduation.

(5) If the pointer is NOT properly aligned to the horizontal graduation, perform either of the two following steps.

(a) Pointer too HIGH: Continue rotating assembly counterclockwise until alignment is achieved.

(b) Pointer too LOW: Rotate pointer assembly clockwise until rotational resistance is felt (does not refer to contact with trip reset shaft). Continue rotating in direction of resistance to compensate for initial misalignment. Release hub

allowing pointer assembly to rotate back to its rest position.

(c) If alignment is not achieved, repeat steps (a) or (b) as required.

(6) Position gauge face plate and secure by installing nuts.

(7) Install screws (Fig. 9).

(8) Position black mask.

(9) Position clear lens and secure with screws (Fig. 7, 8).

(10) Install front switch panel as described in Control Switch Pane Replacement.

(11) Install the cluster as described in Instrument Cluster Replacement.

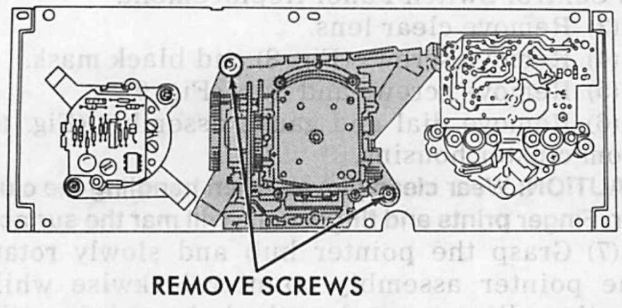


Fig. 11—Remove Screws

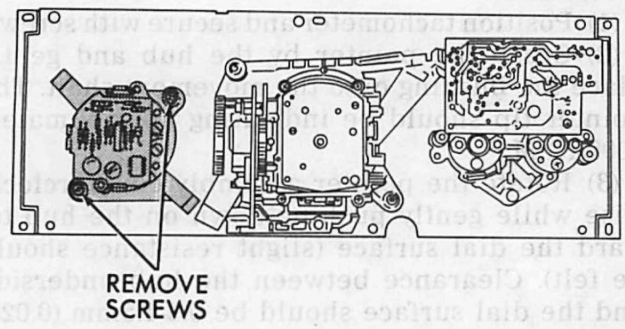


Fig. 12—Remove Screws

Dial and Gauge Assembly

Removal and Installation

(1) Remove the cluster as described in Instrument Cluster Removal.

(2) Remove front switch panel as described in Control Switch Panel Removal.

(3) Remove the speedometer and tachometer as described in Tachometer/Speedometer Removal.

(4) Once the speedometer and tachometer are removed the remaining dial and gauge assembly must be replaced as an assembly.

CAUTION: DO NOT use the old speedometer or tachometer pointer needle. The new needles must be used when the face plate is replaced.

(5) Install speedometer and tachometer to the replacement face plate as described in Tachometer/Speedometer Installation.

(6) Install cluster as described in Instrument Cluster Installation.

Clock/Trip Computer Replacement

(1) Remove the cluster as described in Instrument Cluster Removal.

(2) Remove screws (Fig. 13).

(3) Disconnect electrical connector.

(4) Remove the clock/trip computer module.

(5) To install the clock/trip computer, reverse the removal procedures.

Climate Control/Heater Display Panel

Removal and Installation

(1) Remove the cluster as described in Instrument Cluster Removal.

(2) Remove screws (Fig. 14).

(3) Remove the display panel.

(4) To install display panel, reverse the removal procedures.

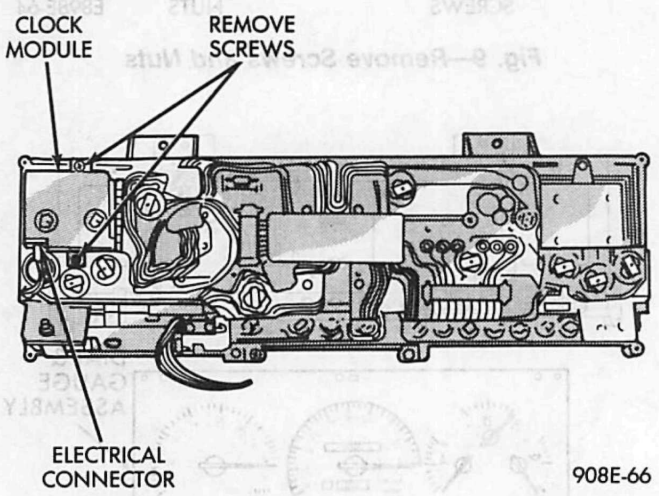


Fig. 13—Clock Module Removal/Installation

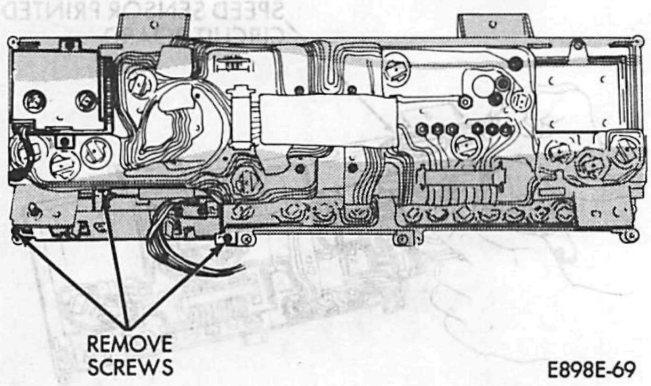


Fig. 14—Climate Control/Heater Display Panel Removal/Installation

Flex Circuit

Removal and Installation

(1) Remove the cluster as described in Instrument Cluster Removal.
(2) Remove all bulbs.
(3) Remove screws (Fig. 16).
(4) Remove nuts (Fig. 16).
(5) Disconnect connectors.
(6) Remove flex circuit.
(7) To install the flex circuit, reverse the removal procedures.
(8) Install all bulbs making sure that bulbs 74 gray are in turn signal positions. Blue lamps must be in the warning display positions.

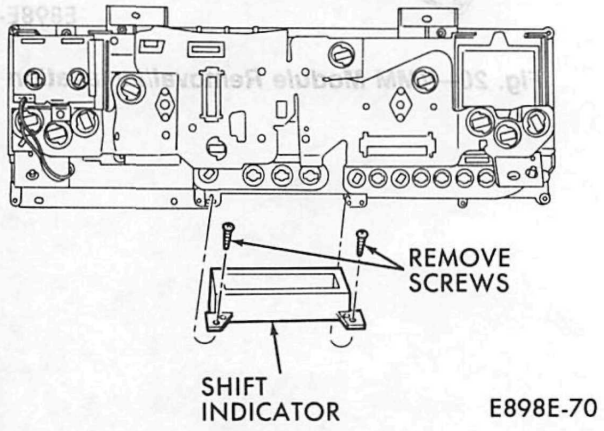


Fig. 15—Shift Indicator Removal/Installation

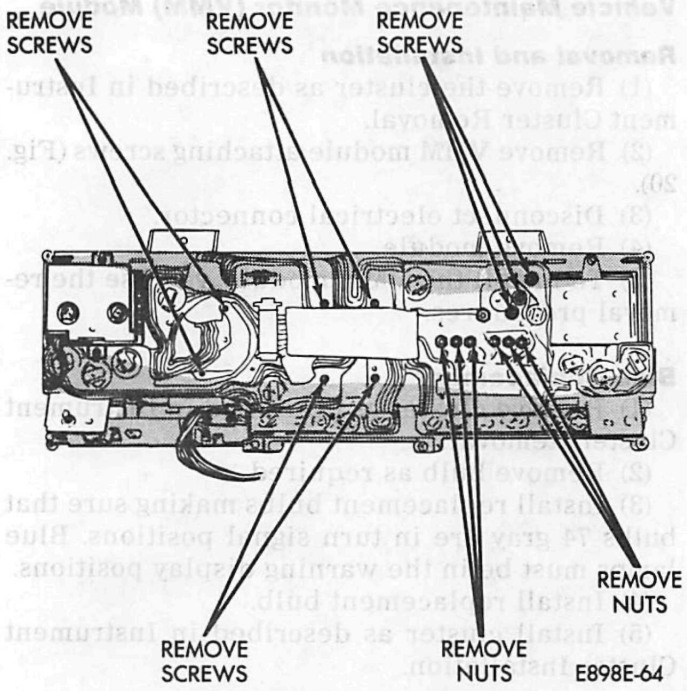


Fig. 16—Remove Screws And Nuts

Speed Sensor Printed Circuit Board

Removal and Installation

(1) Remove the cluster as described in Instrument Cluster Removal.
(2) Remove bulb (Fig. 17).
(3) Move flex circuit to expose screws (Fig. 18).
(4) Remove cover plate (Fig. 18).
(5) Remove speed sensor printed circuit board (Fig. 19).
(6) To install speed sensor printed circuit board, reverse the removal procedures.

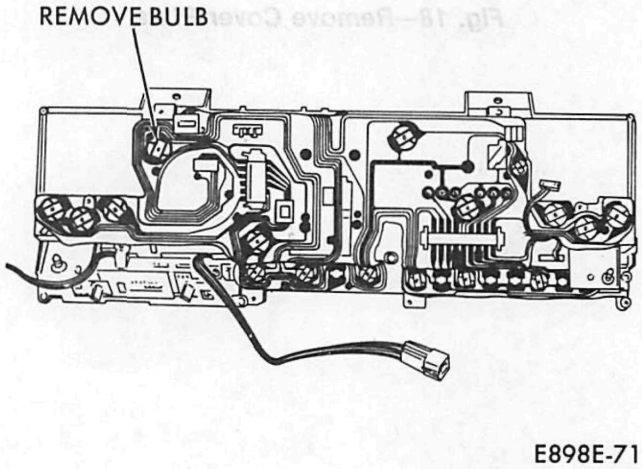


Fig. 17—Remove Bulb

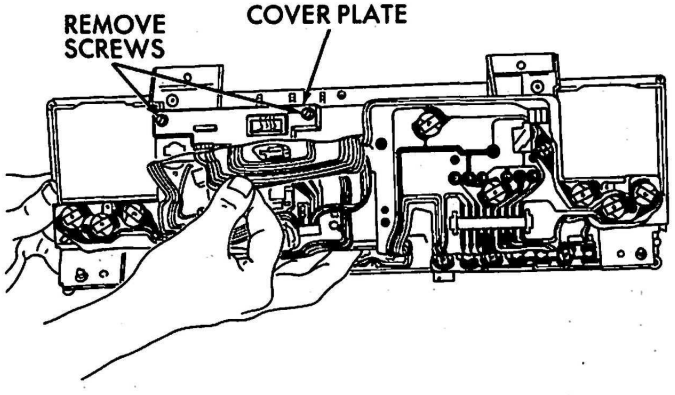
Vehicle Maintenance Monitor (VMM) Module

Removal and Installation

(1) Remove the cluster as described in Instrument Cluster Removal.
(2) Remove VMM module attaching screws (Fig. 20).
(3) Disconnect electrical connector.
(4) Remove module.
(5) To install the VMM module, reverse the removal procedures.

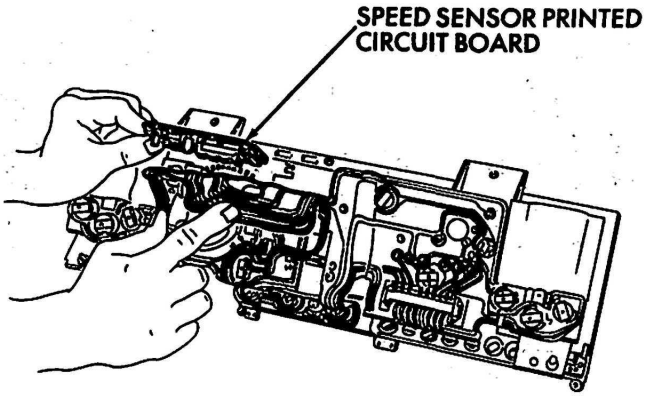
Bulb Replacement

(1) Remove cluster as described in Instrument Cluster Removal.
(2) Remove bulb as required.
(3) Install replacement bulbs making sure that bulbs 74 gray are in turn signal positions. Blue lamps must be in the warning display positions.
(4) Install replacement bulb.
(5) Install cluster as described in Instrument Cluster Installation.



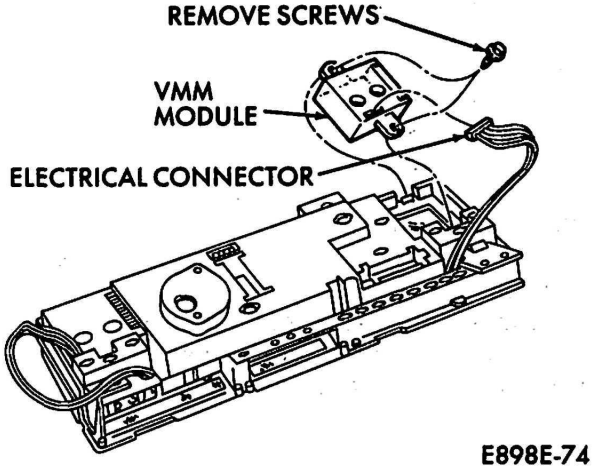
E898E-72

Fig. 18—Remove Cover Plate



E898E-73

Fig. 19—Remove Speed Sensor Printed Circuit Board



E898E-74

Fig. 20—VMM Module Removal/Installation

INSTRUMENT PANEL COMPONENTS

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Lamp Module

Removal and Installation

For diagnostic information refer to Group 8L.

(1) Disconnect battery negative cable.

(2) Remove fuse panel attaching screws (Fig. 1).

(3) Lower fuse panel and remove lamp module retaining screws (Fig. 2).

(4) Disconnect electrical connector (Fig. 3).

(5) Remove lamp module (Fig. 4).

(6) To install the lamp module, reverse the removal procedures.

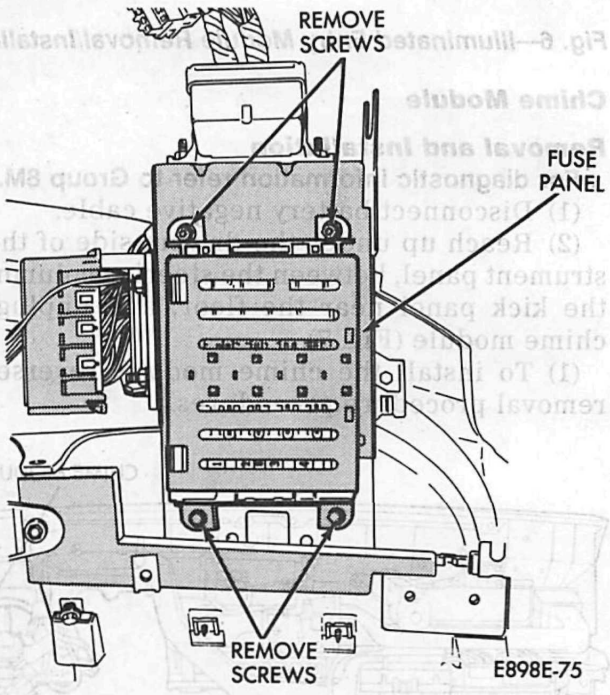


Fig. 1—Remove Fuse Panel

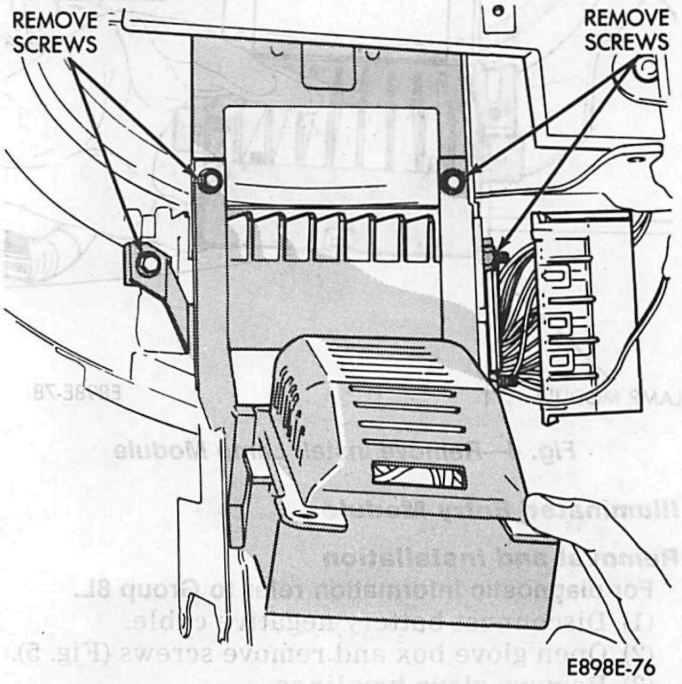


Fig. 2—Remove Screws

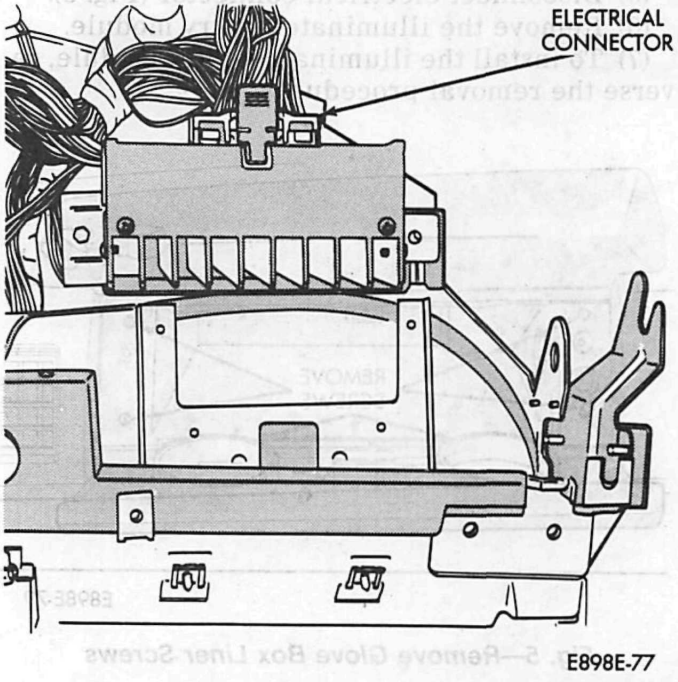


Fig. 3—Disconnect Electrical Connector

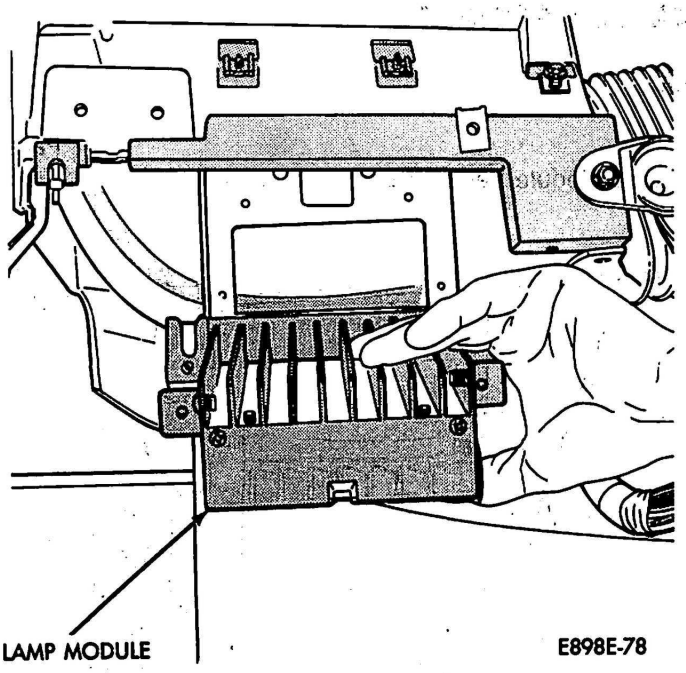


Fig. 4—Remove/Install Lamp Module

Illuminated Entry Module

Removal and Installation

For diagnostic information refer to Group 8L.

(1) Disconnect battery negative cable.
(2) Open glove box and remove screws (Fig. 5).
(3) Remove glove box liner.
(4) Remove screw (Fig. 6) securing the module.
(5) Disconnect electrical connector (Fig. 6).
(6) Remove the illuminated entry module.
(7) To install the illuminated entry module, reverse the removal procedures.

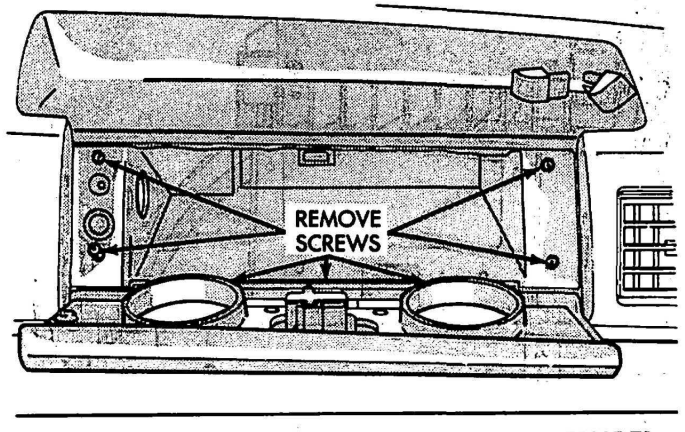


Fig. 5—Remove Glove Box Liner Screws

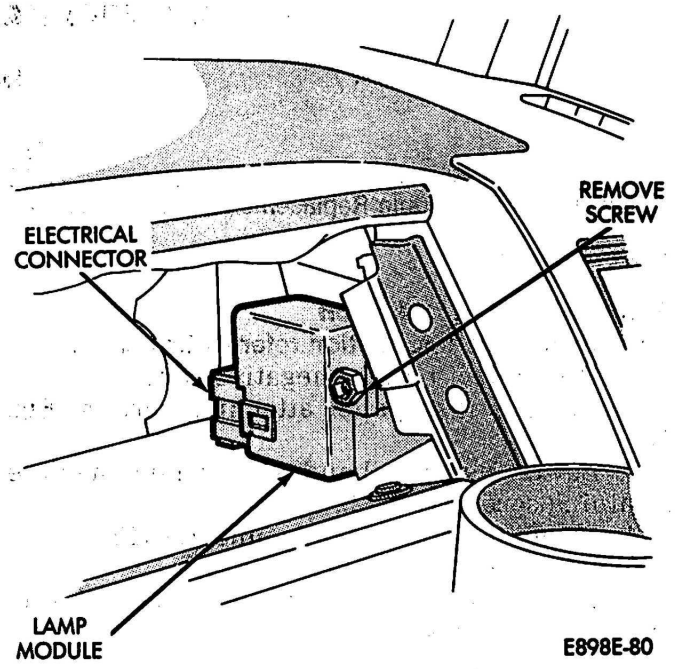


Fig. 6—Illuminated Entry Module Removal/Installation

Chime Module

Removal and Installation

For diagnostic information refer to Group 8M.

(1) Disconnect battery negative cable.
(2) Reach up under the drivers side of the instrument panel, between the steering column and the kick panel near the floor, and unplug the chime module (Fig. 7).

(1) To install the chime module, reverse the removal procedure procedures.

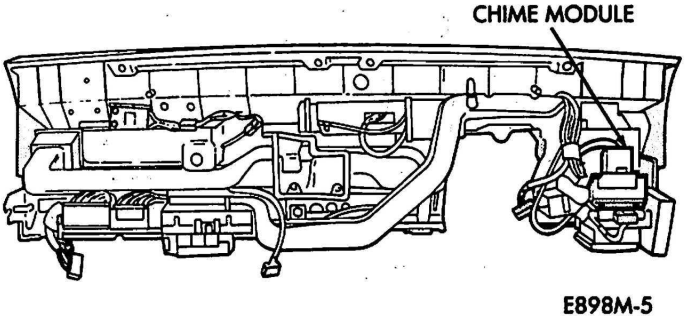


Fig. 7—Chime Module Location

INSTRUMENT PANEL REMOVAL AND INSTALLATION

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WITH PASSIVE RESTRAINT

(1) Remove ash tray by pulling it up and out of ash tray receiver (Fig. 1).
(2) Remove screw holding ash tray receiver.
(3) Disconnect wire from cigar lighter.
(4) Remove two screws holding front of console to bracket.
(5) Remove three screws holding armrest assembly to the console.
(6) Remove the armrest assembly by pulling it up and out of the console.
(7) Remove two screws holding rear of console to bracket.
(8) Reach inside console and push out the seat belt guides.
(9) Remove the console.
(10) Remove two bolts holding the pivot bracket to the knee bolster (Fig. 2).
(11) Loosen but do not remove the two bolts holding the pivot bracket.
(12) Remove one screw and two torx bolts holding the forward console bracket to the vehicle.

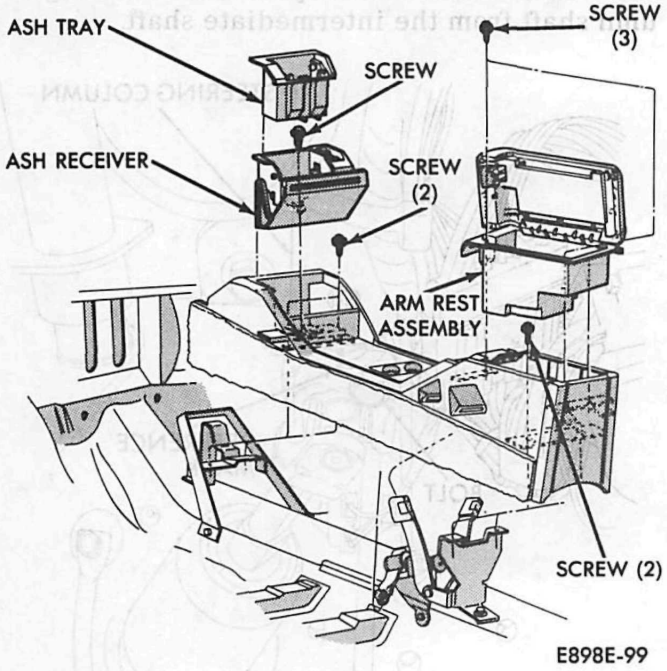


Fig. 1—Center Console Removal/Installation

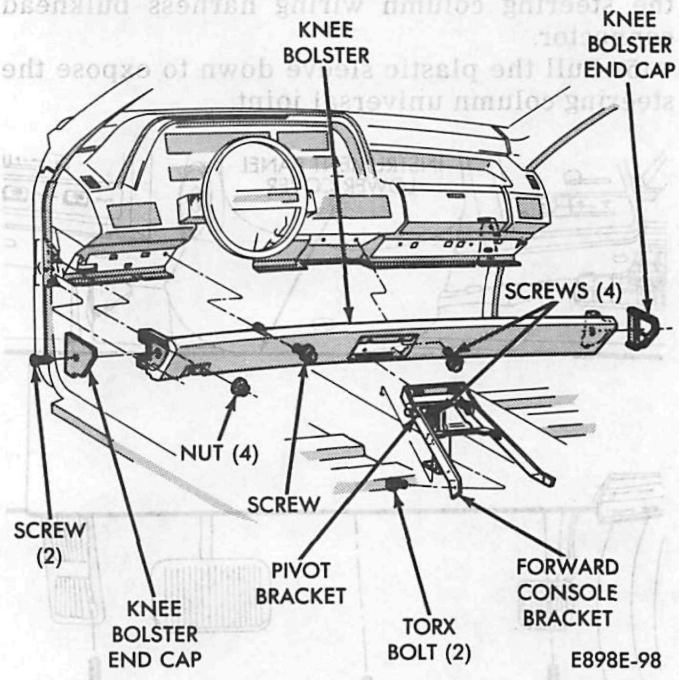


Fig. 2—Knee Bolster Removal/Installation

(13) Slide the forward console bracket back.
(14) Remove two screws holding the center of knee bolster to the instrument panel.
(15) Remove screw located at top of knee bolster just to the left of the steering column.
(16) Remove screw holding air duct to knee bolster.
(17) Remove both knee bolster end caps.
(18) Remove the screw located at the bottom of the instrument panel holding the bottom of the garnish molding.
(19) Remove four nuts holding the ends of the knee bolster.
(20) Move knee bolster toward the rear of the vehicle far enough to gain access to the two screws holding the park brake release handle.
(21) Remove the two screws holding the park brake release handle.
(22) Remove the knee bolster.
(23) Continue with step 3 of Instrument Panel Removal Without Passive Restraint.
(24) To install the knee bolster and center console, reverse the removal procedures.

WITHOUT PASSIVE RESTRAINT

(1) Disconnect the battery negative cable.

(2) Remove screws and instrument panel lower cover (Fig. 1).

(3) Remove bolts that attach the instrument panel support rod (Fig. 2) and remove the rod.

(4) Remove hold down nut (Fig. 3) attaching the steering column wiring harness bulkhead connector.

(5) Pull the plastic sleeve down to expose the steering column universal joint.

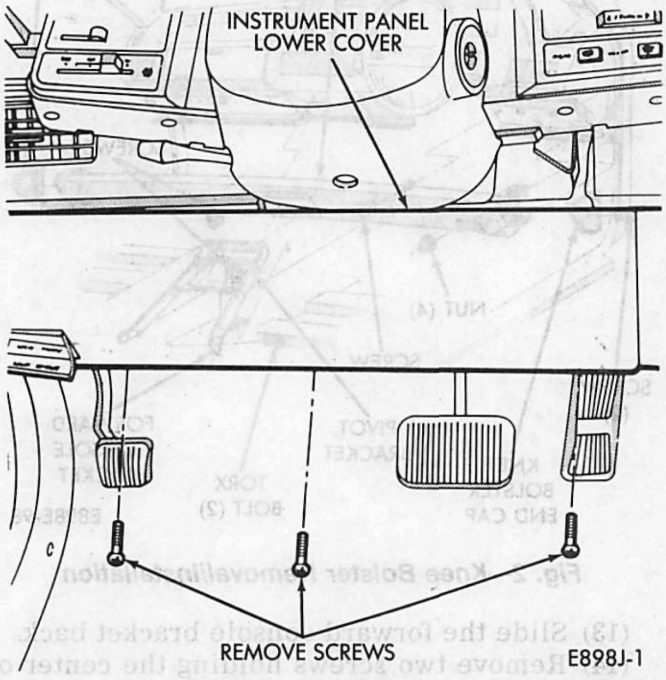


Fig. 1—Remove Instrument Panel Lower Cover

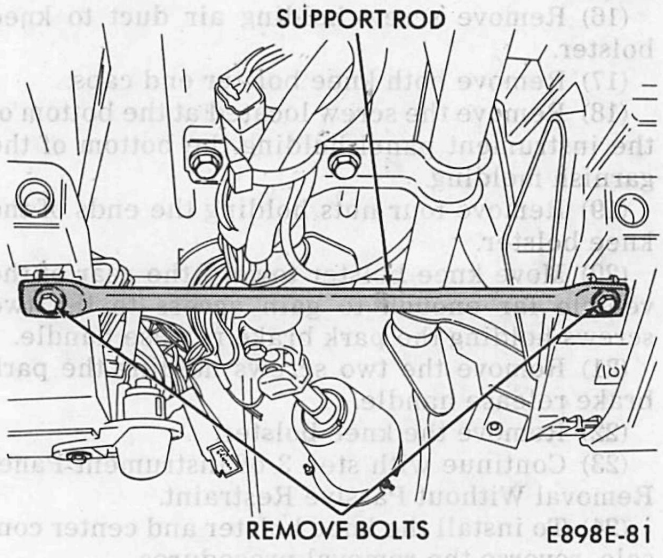


Fig. 2—Remove Support Rod

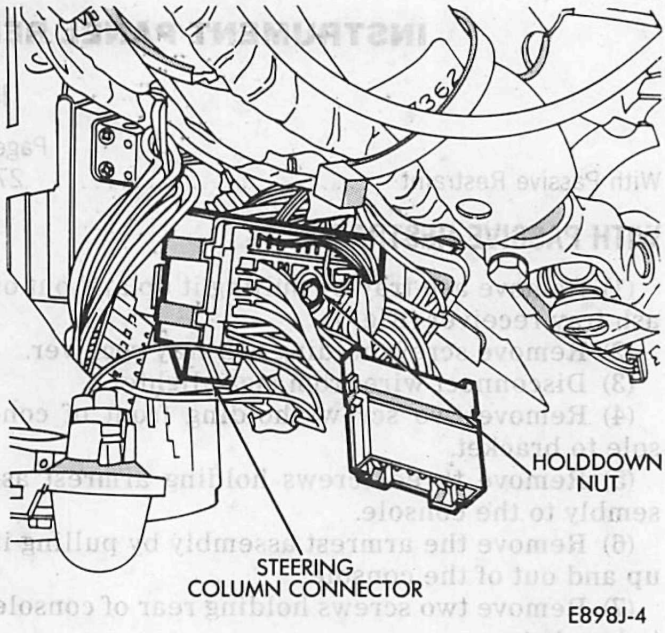


Fig. 3—Loosen Holddown Nut

(6) Make a reference mark (Fig. 4) on the steering column shaft and intermediate shaft.

(7) Remove bolt (Fig. 4) from the intermediate shaft.

(8) Remove bolts and nuts that hold the steering column to the instrument panel/brake sled.

(9) Carefully lower the steering assembly to the vehicle floor. Then separate the steering column shaft from the intermediate shaft.

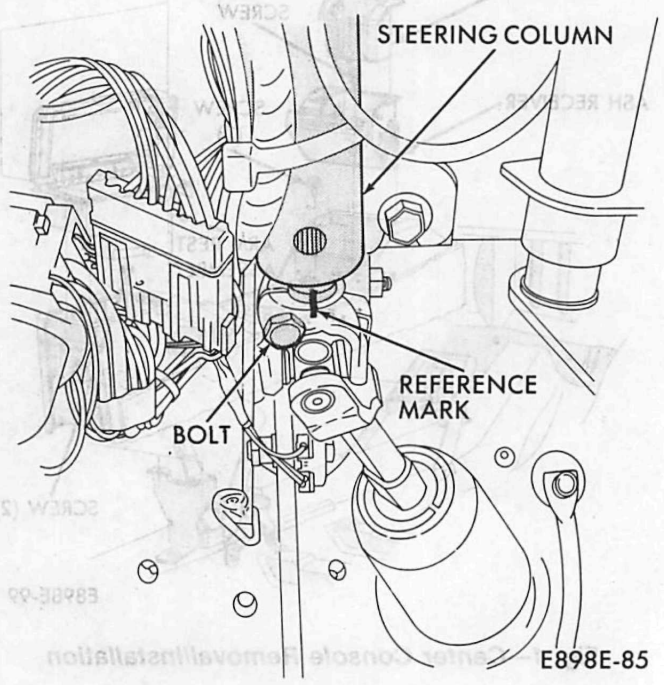


Fig. 4—Mark Steering And Intermediate Shafts

(10) Remove the column assembly from the vehicle.
(11) Remove defroster grille.
(12) Remove bolts under defroster grille.
(13) Loosen but DO NOT remove nut (Fig. 5) located near the parking brake release handle and nut (Fig. 6) which is located on the passenger side kick panel.
(14) Remove screws and lower the parking brake release handle (Non Passive vehicles only).
(15) Remove the ashtray by releasing tab then pulling it forward and out of the instrument panel (Non Passive vehicles only).

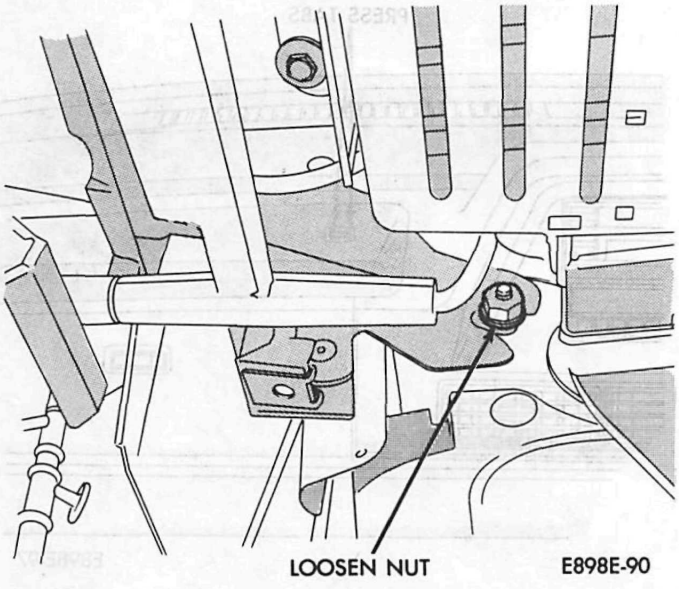


Fig. 5—Loosen But DO NOT Remove Nut

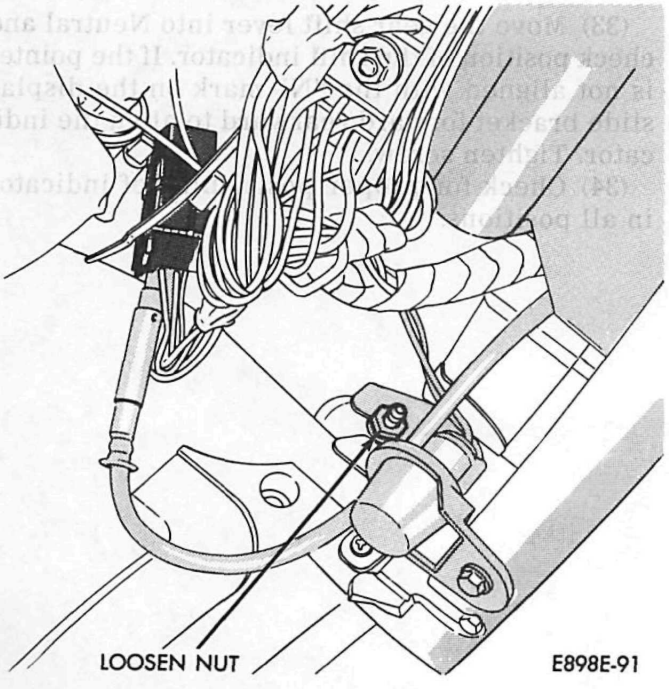


Fig. 6—Loosen But DO NOT Remove Nut

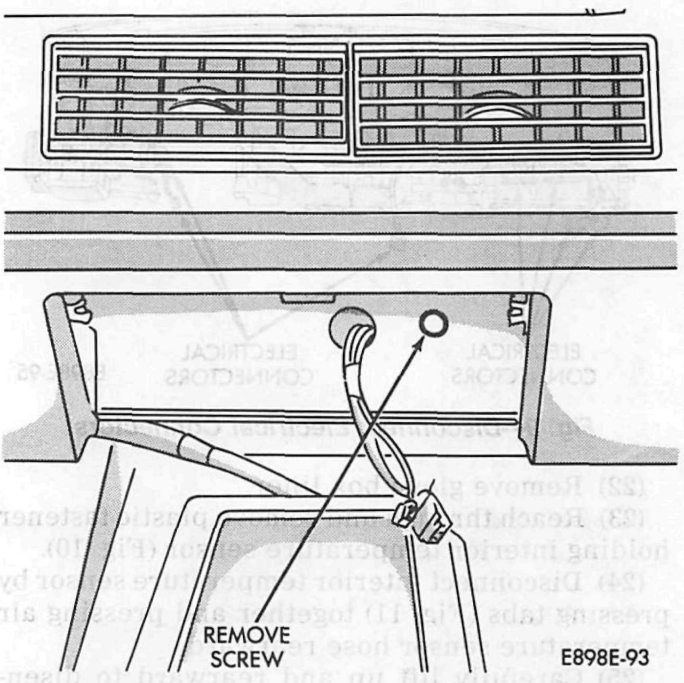


Fig. 7—Remove Screw

(16) Disconnect the cigarette lighter connectors (Non Passive vehicles only).
(17) Remove screw (Fig. 7) from ashtray cavity (Non Passive vehicles only).
(18) Remove bolt (Fig. 8) from brake sled.
(19) Disconnect all electrical Connectors (Fig. 9).
(20) Remove bolts that hold instrument panel to center floor bracket (Non Passive vehicles only).
(21) Open glove box and remove screws.

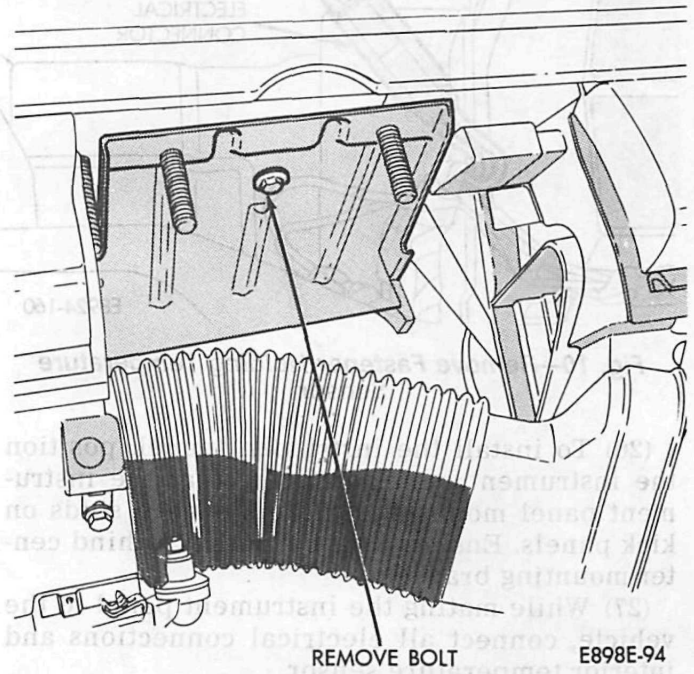


Fig. 8—Remove Bolt

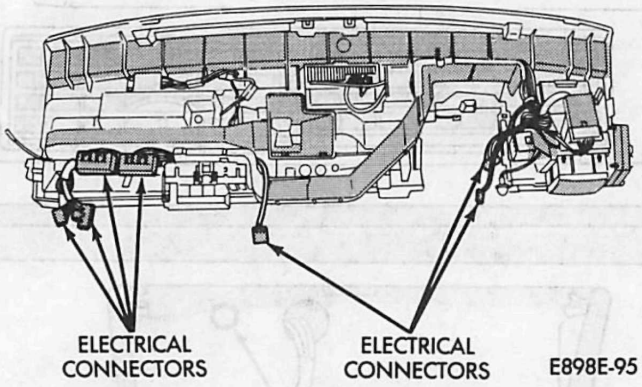


Fig. 9—Disconnect Electrical Connectors

(22) Remove glove box liner.

(23) Reach through and remove plastic fastener holding interior temperature sensor (Fig. 10).

(24) Disconnect interior temperature sensor by pressing tabs (Fig. 11) together and pressing air temperature sensor hose rearward.

(25) Carefully lift up and rearward to disengage and remove the instrument panel.

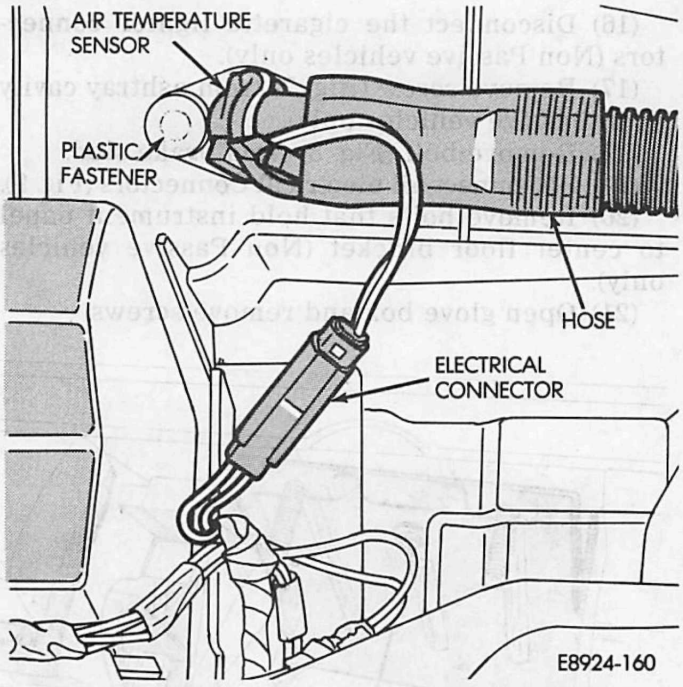


Fig. 10—Remove Fastener Holding Temperature Sensor

(26) To install the instrument panel, position the instrument panel ensuring that the instrument panel mounting brackets engage studs on kick panels. Ensure wire harness is behind center mounting bracket.

(27) While mating the instrument panel to the vehicle, connect all electrical connections and interior temperature sensor.

(28) Reverse the removal procedures to install the instrument panel.

(29) Position and install the steering column shaft in the intermediate steering shaft U-joint. Align the two shafts using the reference mark made during removal.

(30) Install but do not tighten the U-joint bolt.

(31) Lift the steering column into position and install the nuts and bolts that attach the column to the instrument panel. Tighten the bolts/nuts to 45 N·m (35 ft. lbs.) torque.

(32) Tighten the bolt in the intermediate steering shaft U-joint.

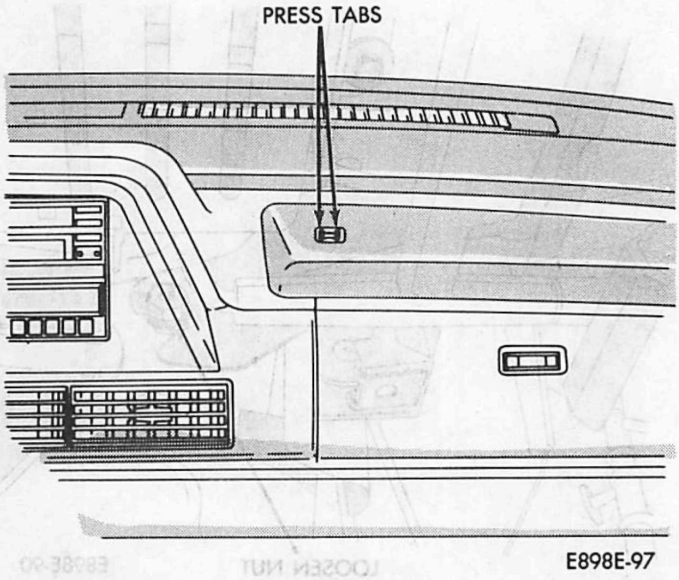


Fig. 11—Disconnect Interior Temperature Sensor

(33) Move the gear shift lever into Neutral and check position of the shift indicator. If the pointer is not aligned with the "N" mark on the display slide bracket forward/rearward to align the indicator. Tighten screw.

(34) Check for proper positioning of indicator in all positions.

RADIO, ANTENNA, SPEAKERS AND COMPACT DISC PLAYER

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GENERAL INFORMATION

GENERAL

The radio is electronically tuned. It features detailed functional graphics in an LCD display. The radio can be programmed to store 20 preset stations. The radio also contains built in diagnostics for speaker and radio system operation checkouts.

There is a fuse mounted in the rear of the radio. There is also a fuse mounted in the fuse box labeled RADIO.

Radio Without Graphic Equalizer

This radio is an electronically tuned AM/FM unit having stereo capability on the AM and FM bands. Standard features include SEEK, MEMORY with indicator light, and LOCAL/DISTANCE selector. This radio is available with or without a cassette player or a compact disc player.

The memory feature is used to store selected stations. The memory indicators will glow when the memory switch is depressed. The SEEK feature operates by pressing the top of the tuning switch to SEARCH for the next higher station and by pressing the bottom of the tuning switch to SEARCH for the next lower station.

Radio with Graphic Equalizer

The premium radio is equipped with a cassette player having Dolby NR™ DNR™ (Dynamic Noise Reduction). The graphic equalizer boosts audio output power, emphasizes or de-emphasizes frequencies, and provides better stereo listening pleasure. The graphic equalizer is a separate unit connected to the radio by the means of connector cables. The speaker system and power antenna are connected directly to the graphic equalizer. The radio's audio signal is supplied to the graphic equalizer and then to the speaker system.

SPEAKERS

Both standard and premium audio systems are custom tuned and balanced to complement the vehicle interior acoustics. The premium system contains two 6" × 9" coaxial speakers, located in the rear shelf; two 5-1/4" woofers in the front doors and two tweeters in the upper front doors.

The standard speaker system includes two 6" × 9" full range speakers in the rear shelf; two 5-1/4" full range speakers in the front doors.

The radio speaker terminals have positive and negative output connections and do not share a common ground. The outputs that power the speakers operate above ground voltage potential. If a speaker terminal or wiring touches the body, damage to the radio's circuitry may result.

ELECTRICAL DIAGNOSIS

GENERAL

The radio receives its main power from the 20 amp fuse 5 with the ignition switch in ACC or RUN. The Instrument Illumination circuit powers the panel lamps. The memory receives power from Fuse 19 (Without Passive Restraint)/Fuse 2 (With Passive Restraint). When the radio is in the on position and the ignition switch is in RUN or START, current flows from the fuse block through the radio to ground.

The power supplies for the graphic equalizer and radio are the same as those for the standard radio except for that they are not supplied directly to the radio. Instead they are supplied directly to the graphic equalizer. The graphic equalizer then supplies back to the radio.

The radio also has a built-in diagnostic radio check which allows testing of the speaker system without removing the speaker themselves.

There is a fuse in the rear of the radio and graphic equalizer that provide protection to the vehicle wiring in case of a component malfunction.

SELF DIAGNOSTICS

To enter the self diagnostic mode, certain push-buttons must be pressed in sequence. Pressing the following push-buttons in sequence will cause audio diagnostic tones to be sent to the speakers: M1, Seek Down, Seek Up, and M5.

The radio will provide tones alternating between 200 and 6.9kHz at one second intervals, for a total of 60 seconds. Pressing any other push-button (except eject and volume) will also stop the test tones. This feature provides signals for a simple test for speaker system continuity; having high and low frequencies present allows for checking woofers and tweeters in premium sound systems as well.

DIAGNOSTIC CHART INDEX (Figs. 1, 2)

CHART NO.	SYMPTOM
1	Radio Inoperative - No Audio Output, No Background Noise
2	No Audio Output on Front Speakers and/or Rear Speakers
3	Distorted Audio Output on One or More Speakers
4	Weak or No reception - No Audio Output, Background Noise Present
5	Memory Inoperative
6	Digital Display Does Not Dim
7	Noise, Interference Changes With Engine Speed

1. Radio Inoperative - No Audio Output, No Background Noise

CIRCUIT CHECK: Ignition Switch In RUN

TEST	OK	NOT OK
Inspect fuse 5	Not blown	Replace fuse
Battery side of fuse	Battery voltage	Repair open from ignition switch
Radio Connector - Terminal L	Battery voltage	Repair open from fuse 5
Radio Connector - Terminal S to ground	Zero ohms. If OK, remove radio for service. NOTE: If equipped with graphic equalizer, continue with test.	Repair open to ground
Substitute known good radio	Problem resolved. Remove original radio for service	Go to next step
Substitute known good graphic equalizer	Problem resolved. Remove original graphic equalizer for service	Remove original radio and original graphic equalizer for service

2. *No Audio Output on Front Speakers and/or Rear Speakers OK*
SPEAKER SYSTEM: Radio ON, Ignition in RUN

TEST	OK	NOT OK
Depress M1, seek down, seek up, and M5 in order.	Two tones will be produced. The tones will alternate at one second intervals for 60 seconds.	Replace speaker as needed and test again

3. *Distorted Audio Output on One or More Speakers*
SPEAKER SYSTEM; Radio ON

TEST	OK	NOT OK
Substitute known good speaker or speakers	Non-distorted audio output	Remove radio or graphic equalizer for service

4. *Weak or No Reception; No Audio Output; Background Noise Present**
ANTENNA ASSEMBLY: Ignition Switch in RUN, Radio ON

TEST	OK	NOT OK
Check that antenna mast is raised	Mast raised	Refer to Power Antenna circuit
Inspect antenna cable and connector at radio	Not disconnected, loose, or broken	Reconnect or replace antenna as required
Unplug cable connectors from radio. Center conductor to coaxial shield.	Infinite resistance (open)	Replace antenna assembly
Antenna mast to tip of center conductor at radio end of cable	0 to 0.5 ohms	Replace antenna assembly
Coaxial shield to chassis ground (vehicle body)	Zero ohms	Ground antenna base to vehicle or replace antenna assembly as required

*For all problems with no or low audio output not resolved by this test, remove radio or graphic equalizer for service

5. *Memory Inoperative*
Battery Feed

TEST	OK	NOT OK
Inspect Fuse 19 (Without Passive Restraint System)/Fuse 2 (With Passive Restraint System)	Not blown	Battery voltage
Replace Fuse 19 (With Passive Restraint System)/Fuse 2 (With Passive Restraint System)	Battery side of fuse	Repair open from battery.
Radio connector - Terminal K	Battery voltage. If OK, remove Radio or graphic equalizer for service	Repair open from Fuse 19 (Without Passive Restraint System)/Fuse 2 (With Passive Restraint System)

6. *Digital Display Does Not Dim*
Refer to Instrument panel illumination

7. *Noise, Interference Changes With Engine Speed*

RADIO INTERFERENCE SUPPRESSION

TEST	OK	NOT OK
Inspect connections at: -Alternator -Ignition Module -Capacitor -Antenna coaxial ground -Radio ground -Body to transmission braided ground	Inspection points OK	Repair connections as required
Inspect ignition secondary -Wire routing -Condition of wire insulation -Distributor rotor	Secondary OK	Reroute or replace wiring Apply silicone grease to rotor tip

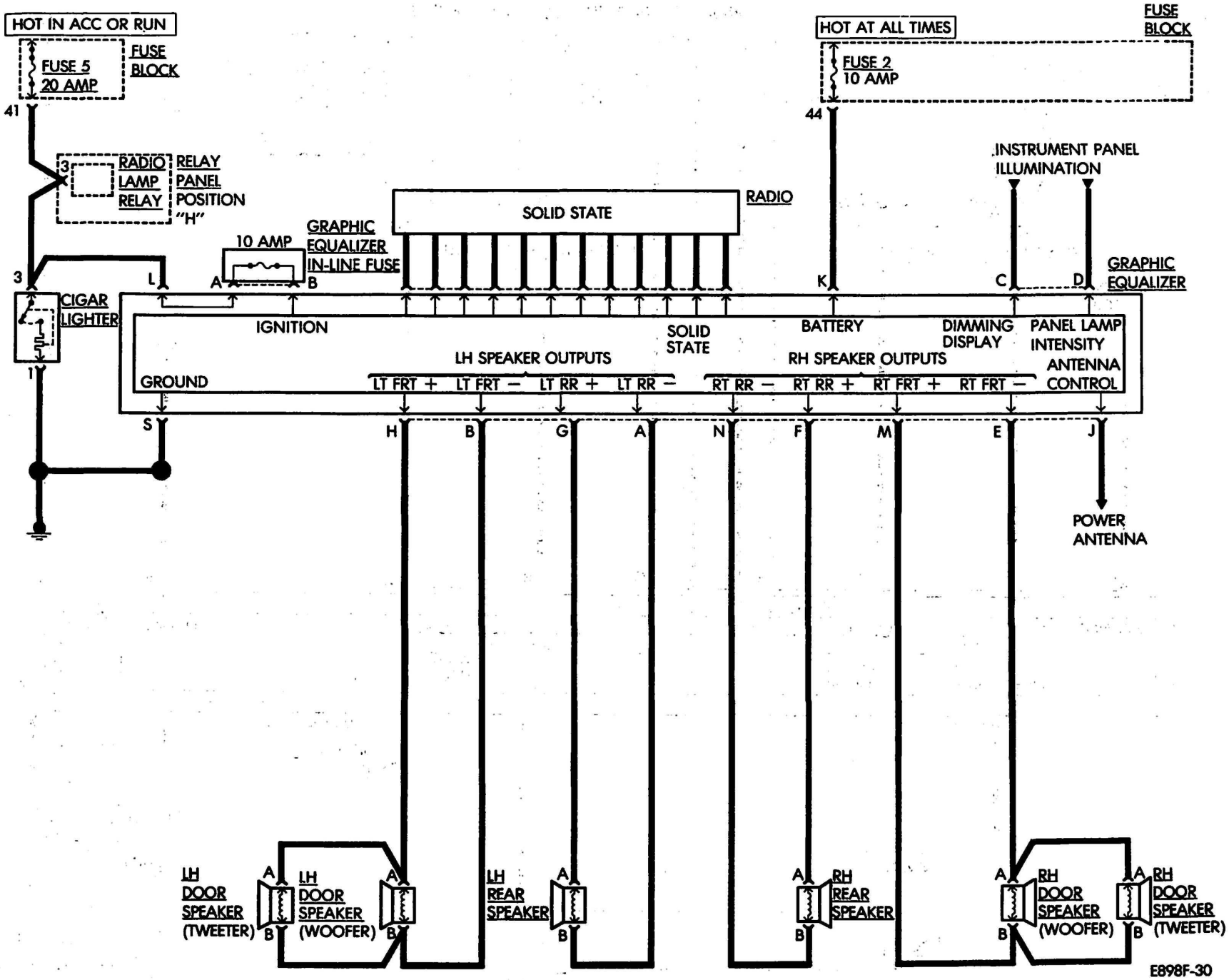


Fig. 1—Radio Without Graphic Equalizer

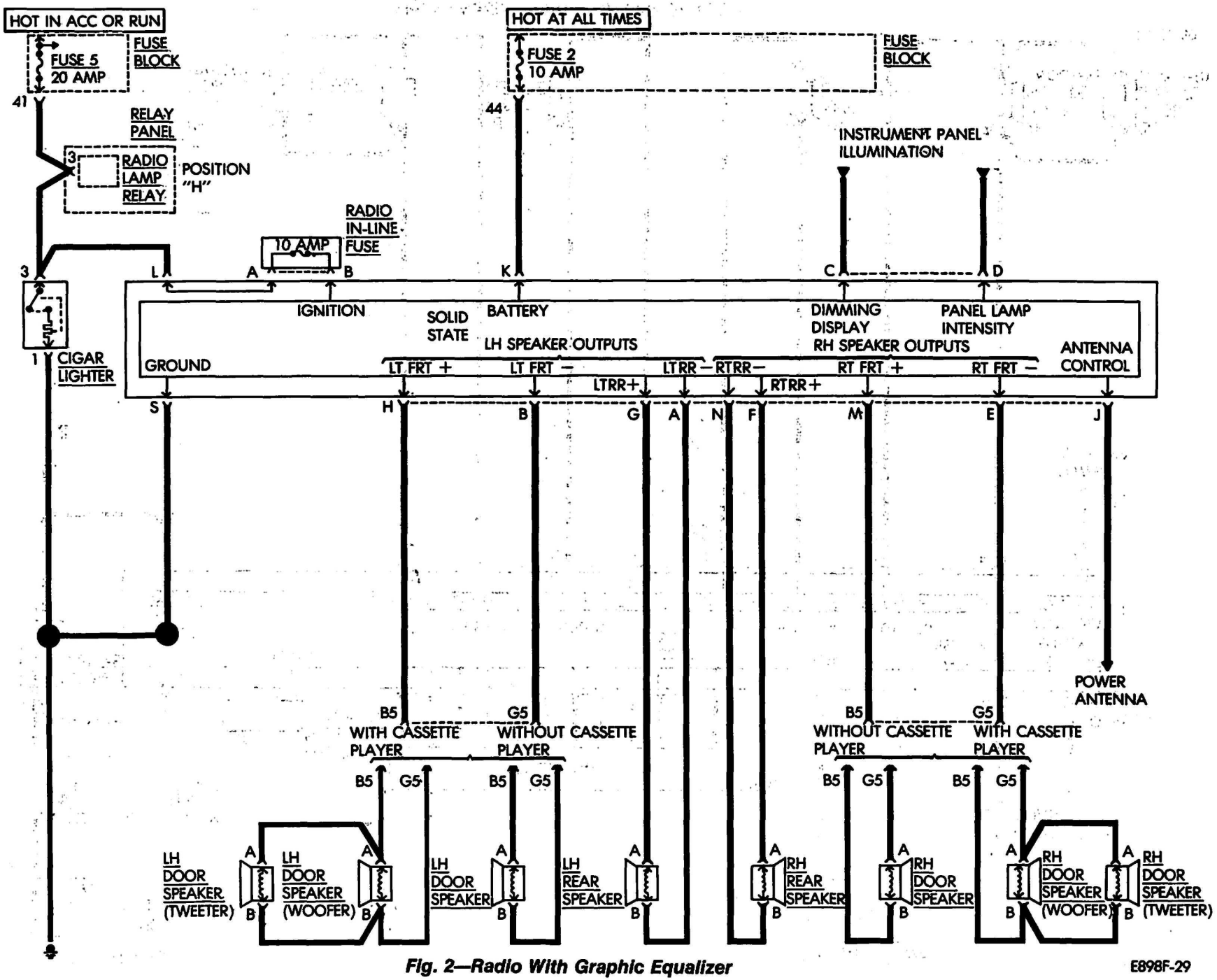


Fig. 2—Radio With Graphic Equalizer

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RADIO REPLACEMENT

Removal

(1) Remove the instrument cluster bezel (Fig. 3) by removing screws.
(2) Remove radio mounting screws (Fig. 4).
(3) Pull the radio forward and out of the instrument panel.
(4) Disconnect electrical connector (Fig. 5).
(5) Disconnect ground wire (Fig. 5).
(6) Unplug antenna wire.

Installation

(1) Plug in antenna wire (Fig. 5).
(2) Connect electrical connector.
(3) Attach ground wire.
(4) Position radio into instrument panel and secure with screws (Fig. 4).
(5) Position instrument cluster bezel and secure with screws (Fig. 3).

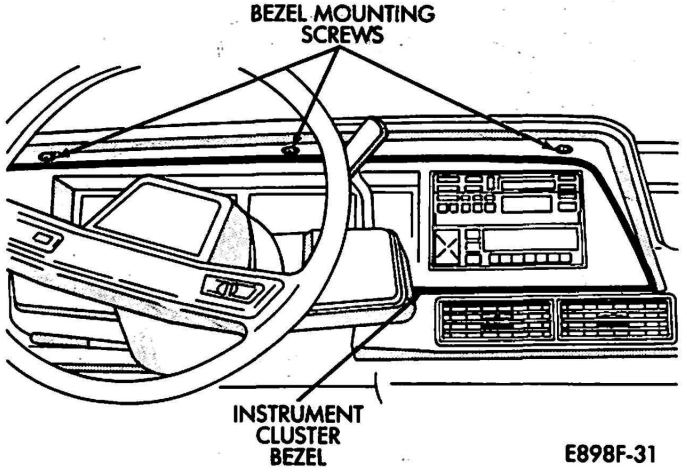


Fig. 3—Instrument Cluster Bezel Removal/Installation

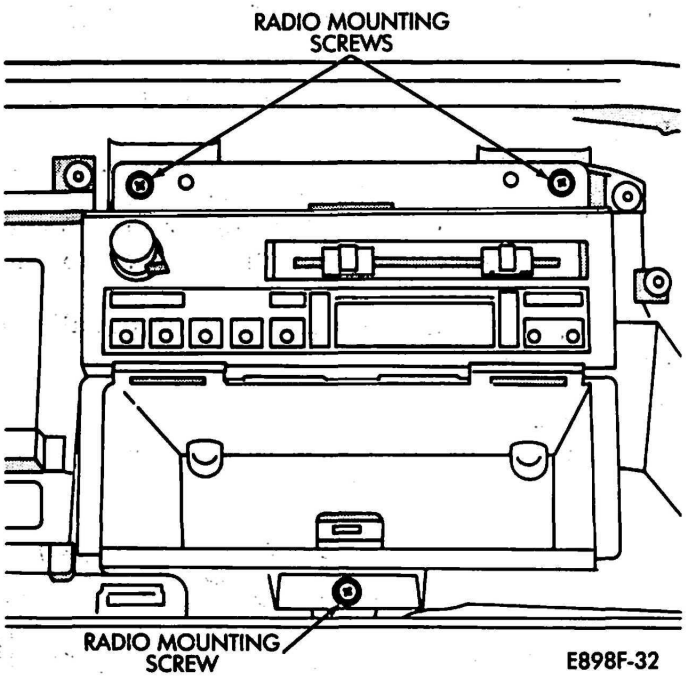


Fig. 4—Radio Removal/Installation

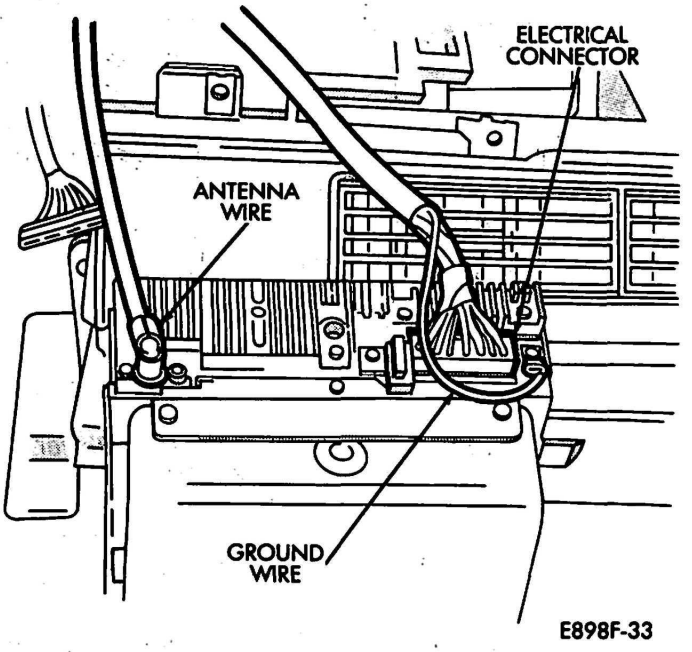


Fig. 5—Disconnect Electrical Connections

GRAPHIC EQUALIZER/COMPACT DISC PLAYER

Removal

(1) Remove the radio as described in Radio Removal.

(2) Disconnect cable that runs between the radio and graphic equalizer/compact disc player.

(3) Remove the screws that hold the radio and graphic equalizer/compact disc player to the bracket (Fig. 6).

(4) Separate the radio and graphic equalizer/compact disc player.

Installation

(1) Position plastic spacer (Fig. 7) between the radio and equalizer.

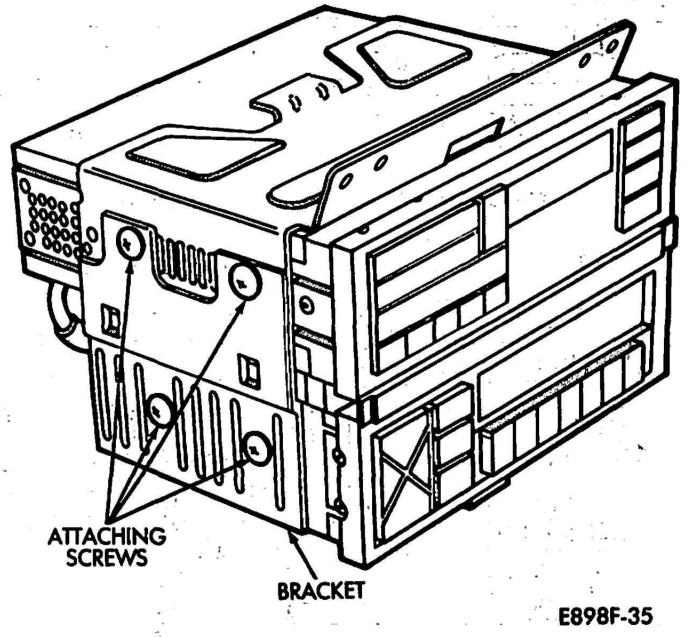


Fig. 6—Graphic Equalizer/Compact Disc Player Bracket Removal/Installation

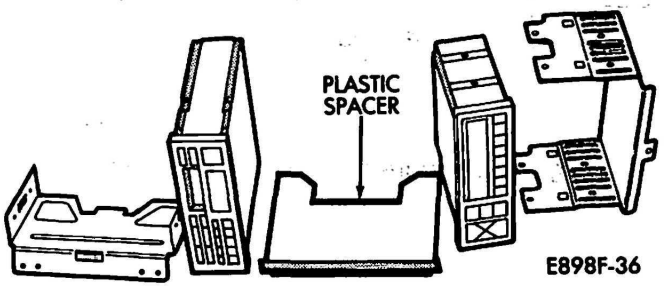


Fig. 7—Position Plastic Spacer

(2) Position radio/equalizer assembly into bracket (Fig. 6).

(3) Secure assembly to bracket by installing screws.

(4) Install assembly into instrument panel as described in Radio Installation.

REMOTE AMPLIFIER

Removal and Installation

(1) Remove passenger side seat.

(2) Remove amplifier mounting screws.

(3) Disconnect electrical connections.

(4) For Installation, Reverse removal procedure.

DOOR SPEAKER REPLACEMENT

Removal

(1) Remove door lock button by pressing lock tab in and lifting (Fig. 1).

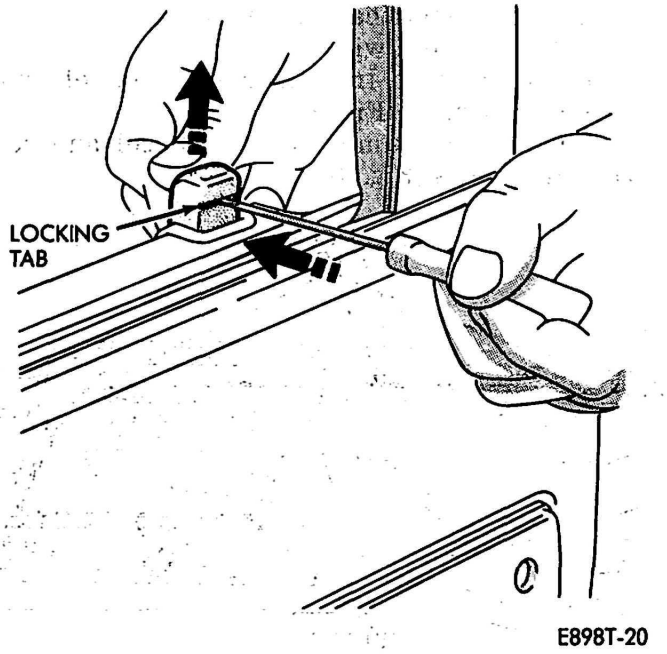


Fig. 1—Lock Button Removal

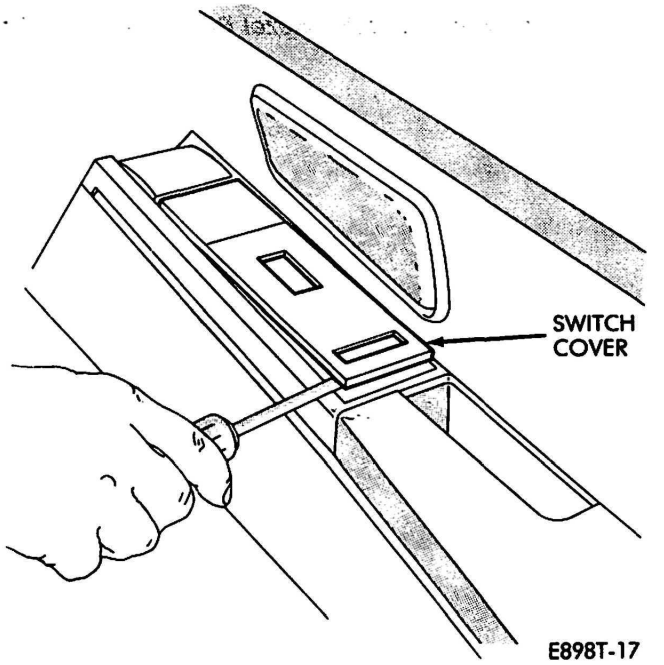
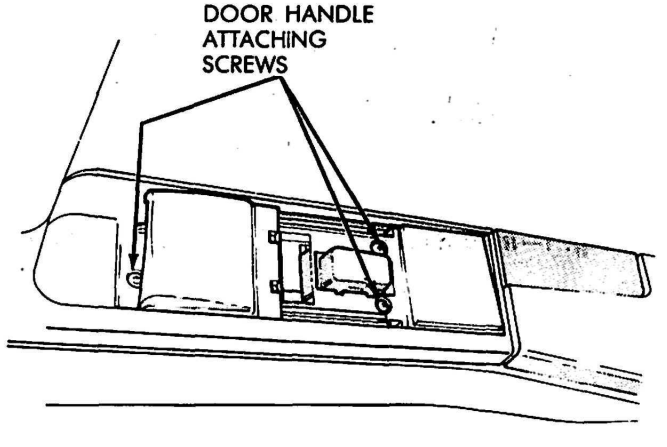


Fig. 2—Switch Cover Removal

(2) Remove the plastic bezel (Fig. 2) covering the switches by prying up the rear of the bezel. Once the rear of the bezel is free, move the bezel to the rear.
(3) Remove door handle by removing screws (Fig. 3).
(4) Remove switch attaching screws (Fig. 4).
(5) Remove trim panel screw.
(6) Remove switch assembly.
(7) Pull window crank off, if equipped.
(8) Remove the door trim panel. Use a trim clip removal tool pry the trim panel loose from the door inner panel (Fig. 5). Lift the panel from the door.
(9) Remove plastic door liner (water dam) from door.
(10) Remove screws holding the speaker in place.
(11) Remove speaker from door.
(12) Disconnect speaker connector.

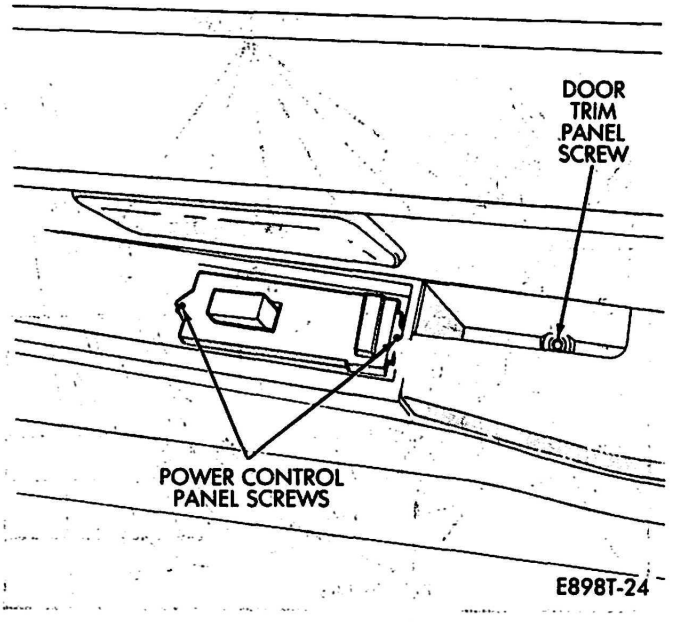
Installation

(1) Connect speaker connector.
(2) Position speaker and secure with screws.
(3) Install plastic liner by pressing it to the door frame.
(4) Install door trim panel by engaging lip at top of panel to anchors on door and engaging plastic retaining clips on door panel to holes in door (Fig. 6).
(5) Position switch assembly (Fig. 4).
(6) Install switch and door panel screws and.
(7) Install door handle with screws (Fig. 3).
(8) Install plastic bezel (Fig. 2) by engaging front then snapping it into place.
(9) Install lock button by pressing it onto the lock rod.
(10) Install window crank, if equipped.



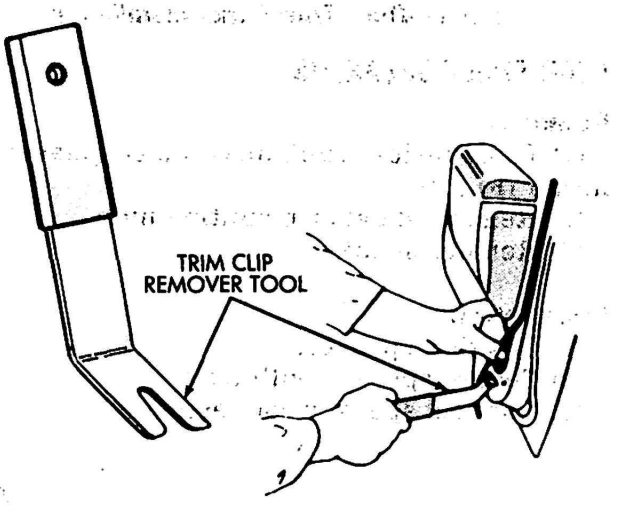
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Fig. 3—Door Handle Removal/Installation



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Fig. 4—Switch Removal/Installation



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Fig. 5—Trim Panel Removal

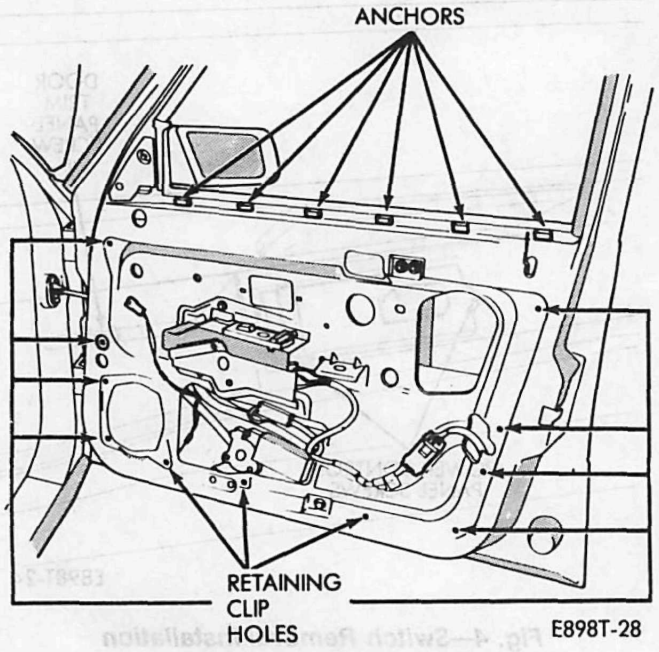


Fig. 6—Door Trim Panel Installation

REAR SHELF SPEAKERS

Removal

(1) From inside trunk disconnect speaker connector (Fig. 7).
(2) Remove speaker mounting nuts.
(3) Remove speaker.

Installation

(1) Position speaker.
(2) Secure speaker with nuts.
(3) Connect speaker connector.

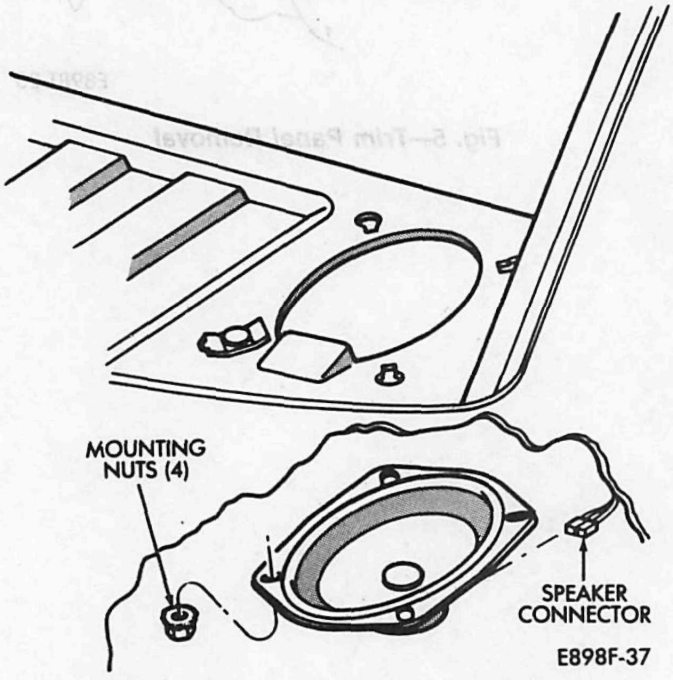


Fig. 7—Rear Shelf Speaker Connector

STANDARD ANTENNA

Removal

(1) Disconnect antenna cable at passenger side kick panel.

Antenna coax cable has a connector with barbs on it. To separate, press together and twist to remove.

(2) Remove screws (Fig. 1) from inner fender liner.
(3) Remove inner fender liner.
(4) Remove capnut and adaptor (Fig. 2).
(5) Lower antenna from fender.
(6) Push grommet (Fig. 3) outward from hole in the A pillar.
(7) Remove the antenna cable assembly.

Installation

(1) Position antenna up through hole in fender.
(2) Slide adaptor (Fig. 2) over antenna.
(3) Install capnut.
(4) Guide antenna cable through hole in the A pillar and press grommet (Fig. 3) in position.
(5) Connect antenna cable at passenger side kick panel.

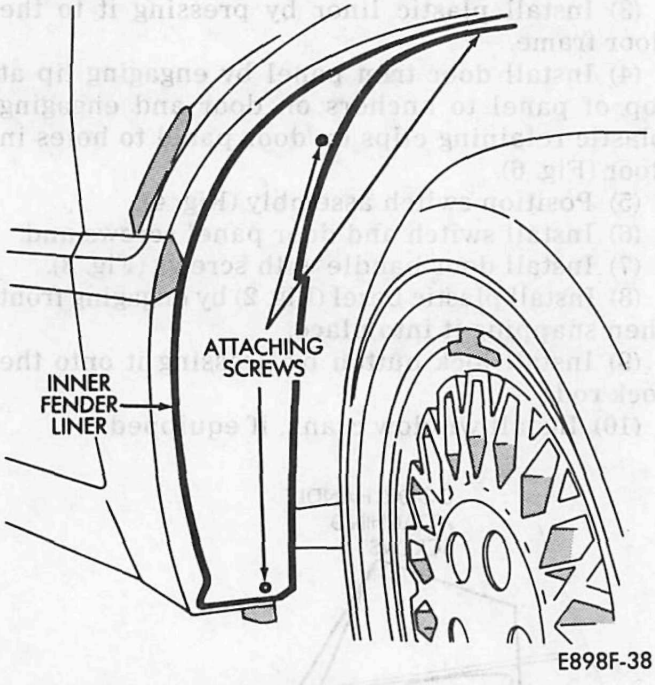


Fig. 1—Inner Fender Liner Removal/Installation

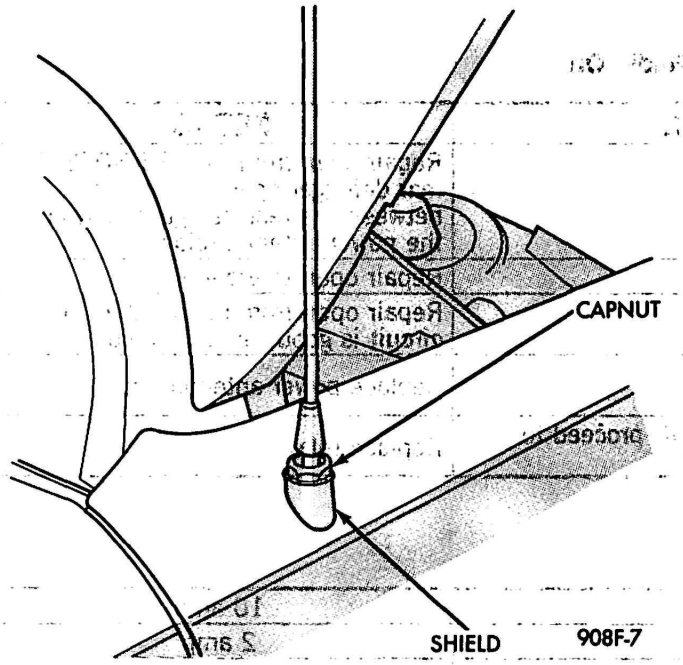


Fig. 2—Antenna Mount Removal/Installation

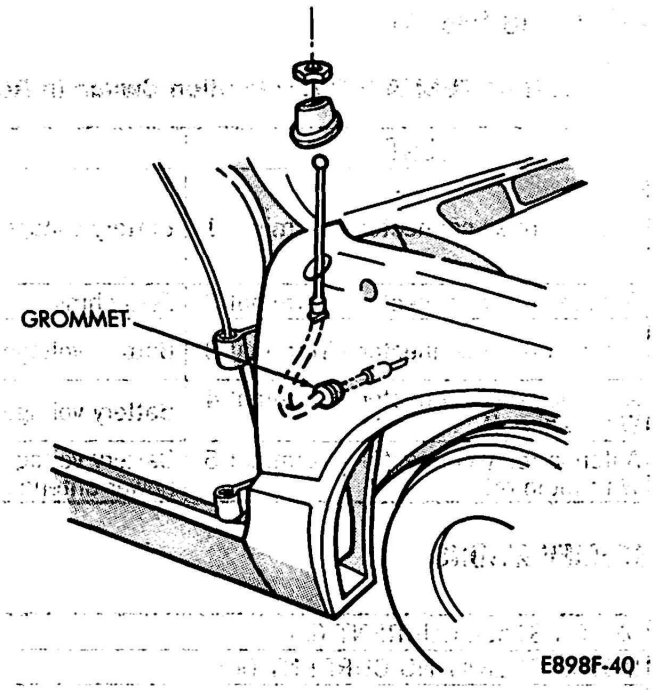


Fig. 3—Antenna Cable Removal/Installation

POWER ANTENNA

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GENERAL INFORMATION

When the radio is turned on, battery voltage is applied to the antenna relay coil. The antenna relay contacts close and battery voltage is applied from fuse 16 through the relay contacts to the antenna relay connector terminal 4, then to the antenna motor. The other motor terminal is grounded through the up switch, the GRY/BLK wire, and the relay contacts. The motor drives the antenna up. At the end of its travel, the up switch opens and the motor stops.

When the radio or ignition is turned off, the circuit through the antenna relay coil relay is opened. The contacts open to the position shown in the schematic, applying battery voltage to the WHT wire. The GRN wire is now grounded. The voltage to the motor has reversed polarity, since the down switch at the antenna is now making contact with the WHT wire. The motor runs in the opposite direction and drives the antenna down.

DIAGNOSIS (Fig. 1)

POWER ANTENNA RELAY: Ignition Switch in RUN, Radio On

TEST	OK	NOT OK
Antenna relay connector - Terminal 1	Battery voltage	Repair open from fuse 16 NOTE: If rear defogger operates, open is between the rear defogger relay and the power antenna relay
Antenna relay connector - Terminal 2	Zero ohms	Repair open to ground
Antenna relay connector - Terminal 3	Battery voltage	Repair open from radio NOTE: If circuit is good, replace radio
Antenna relay connector - Terminal 4 With radio off	Battery voltage	Replace power antenna relay
Antenna relay connector - Terminal 5 With radio off	Battery voltage If OK, proceed to power antenna test	Replace relay

SPECIFICATIONS

MOTOR STALL CURRENT (Is)	10 amp
MOTOR OPERATING CURRENT (Io)	2 amp
MAST EXTENSION/RETRACTION TIME	2-9 secs.
MAST EXTENSION/RETRACTION FORCE	64 ± 20
CAPACITANCE ± 10 pf	51 ±10pf
No. of SECTIONS	4 sections
LENGTH OF MAST	772± 20mm
WEIGHT	0.93 KG

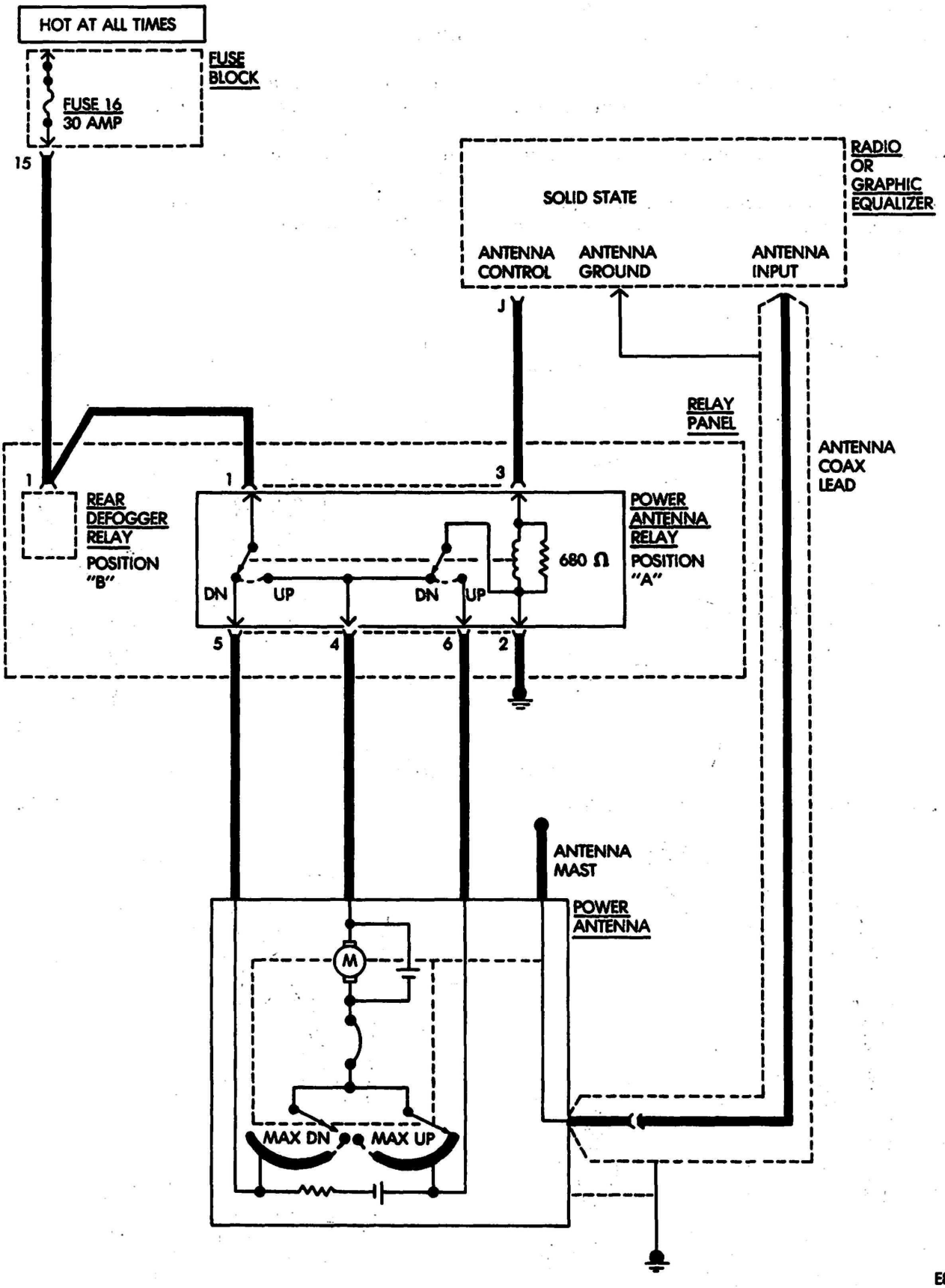


Fig. 1—Power Antenna Wiring Diagram

Removal

(1) Remove capnut and adaptor (Fig. 2).

(2) Remove screws (Fig. 3) from inner fender liner.

(3) Remove inner fender liner.

(4) Remove screw (Fig. 4) from antenna mounting bracket.

(5) Lower motor assembly and remove grommet (Fig. 5) from the A pillar.

(6) Disconnect electrical connector (Fig. 6).

(7) Disconnect antenna cable at passenger side kick panel.

(8) Remove power antenna assembly.

Installation

(1) Guide antenna cable through A pillar and connect to antenna cable coming from the radio.

(2) Connect electrical connector (Fig. 6).

(3) Position antenna up through the hole in the fender and secure with screw (Fig. 4).

(4) Install grommet into A pillar.

(5) Install adapter and capnut on antenna.

(6) Position inner fender panel and secure with screws (Fig. 3).

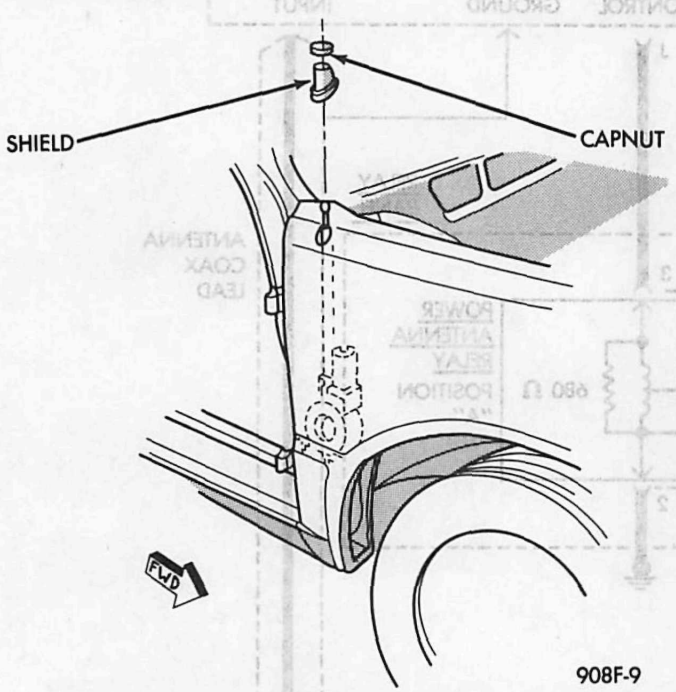


Fig. 2—Antenna Mount Removal/Installation

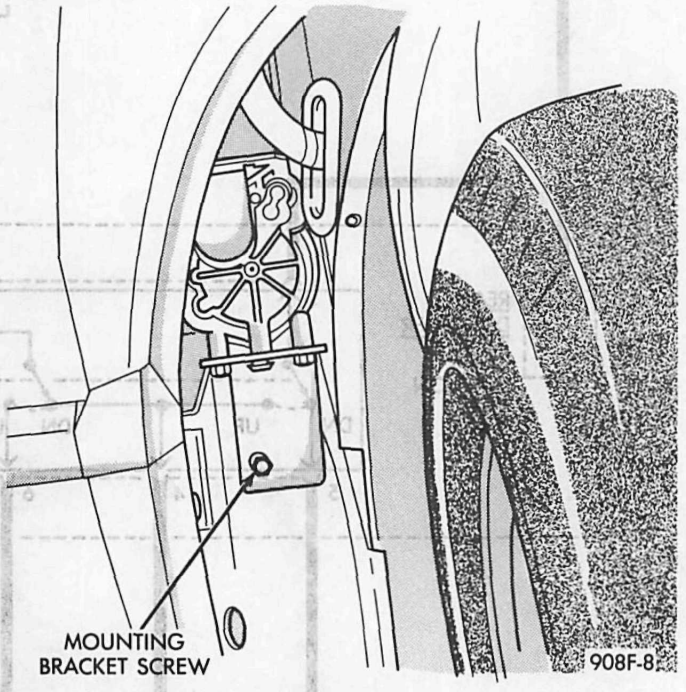


Fig. 4—Antenna Motor Removal/Installation

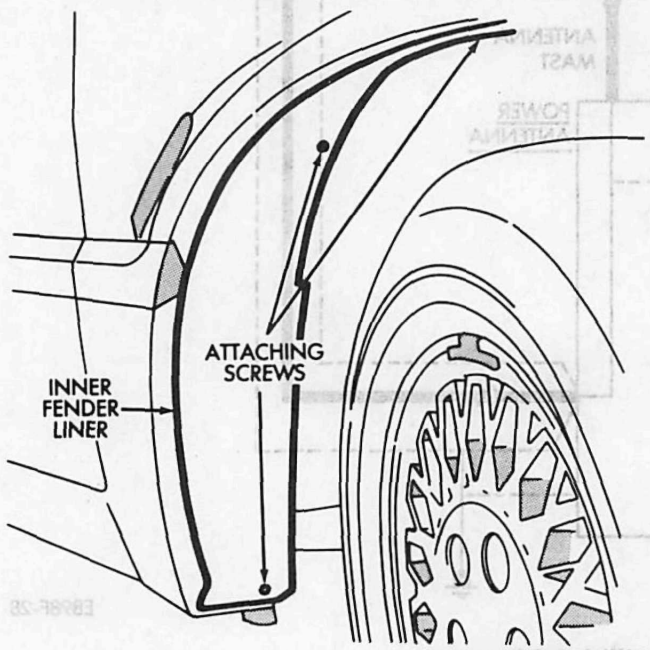


Fig. 3—Inner Fender Liner Removal/Installation

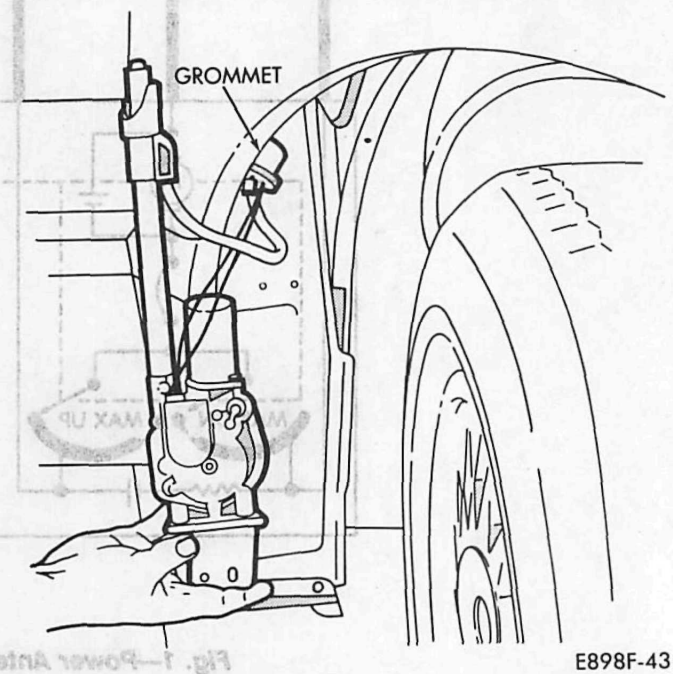


Fig. 5—Remove Antenna Cable Grommet

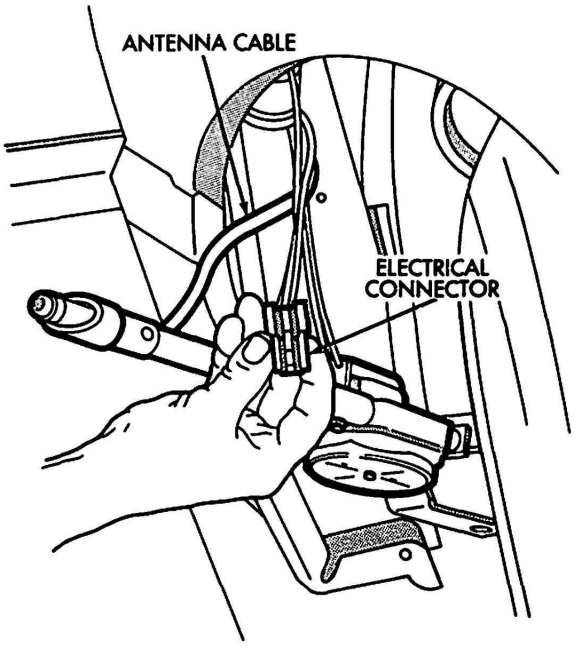


Fig. 6—Disconnect Electrical Connectors

HORN

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DIAGNOSIS (Fig. 1)

General

Battery voltage is available at all times at the horn relay from fuse 18. Depressing the horn switch provides a ground for the horn relay. The relay energizes, closes the contact and applies battery voltage to the horns.

Horn Relay: Horn Switch Depressed

TEST	OK	NOT OK
Horn Relay connector - Terminals 1 and 2	Battery voltage	Repair open between horn relay and Fuse 18: NOTE: If stop lamps are ok, Fuse 18 is good.
Horn Relay connector - Terminal 5	Zero volts	Repair open between the horn relay and ground
Horn Relay connector - Terminal 4	Battery voltage	Replace horn relay

Horn: Horn Switch Depressed

TEST	OK	NOT OK
Horn connectors	Battery voltage Replace horns	Repair open between horns and the horn relay

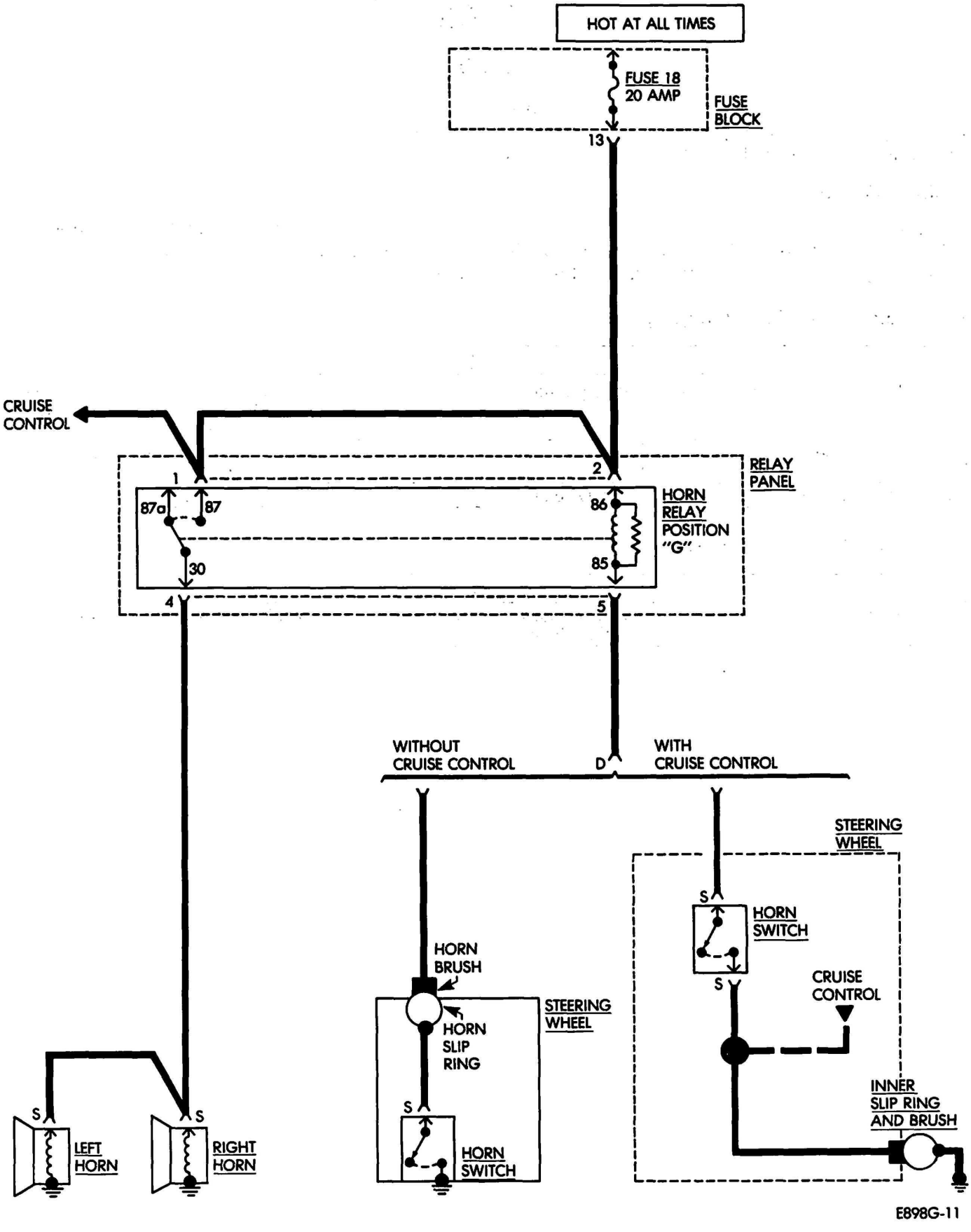


Fig. 1—Horn Circuit Wiring Diagram

HORN

Removal and Installation

(1) Disconnect horn connectors (Fig. 2).
(2) Remove horn bracket mounting screw.
(3) To install the horns, reverse the removal procedures.

HORN SWITCH

Removal and Installation

(1) Unsnap the horn button (Fig. 3).
(2) Disconnect horn wires (Fig. 4) and remove the horn button.
(3) To install the horn switch, reverse the removal procedures.

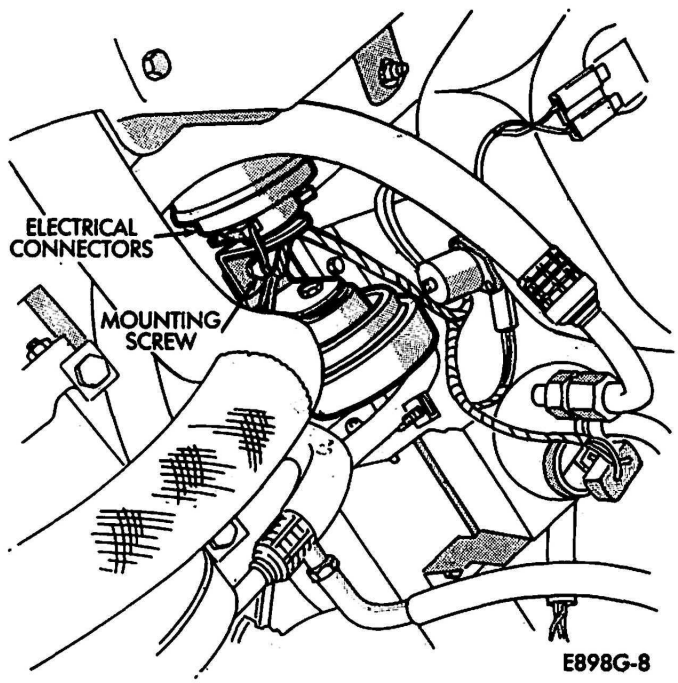


Fig. 2—Horn Removal/Installation

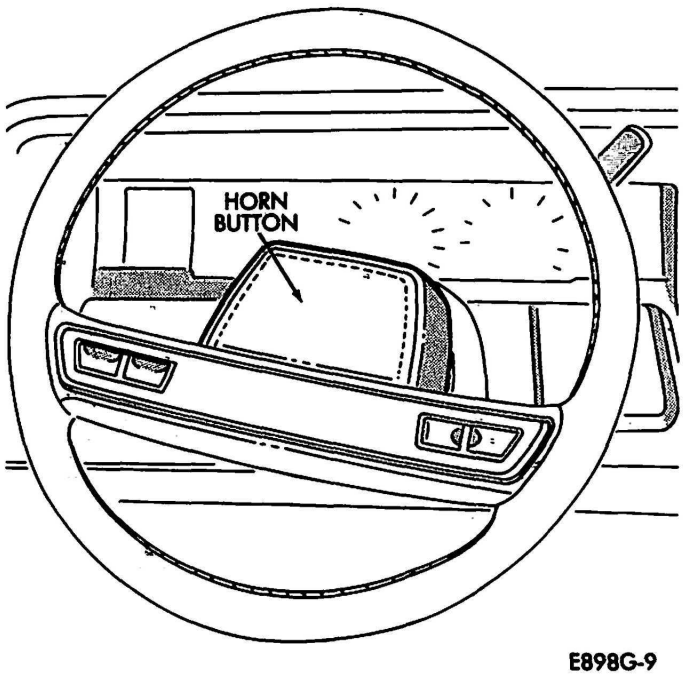


Fig. 3—Horn Button Removal

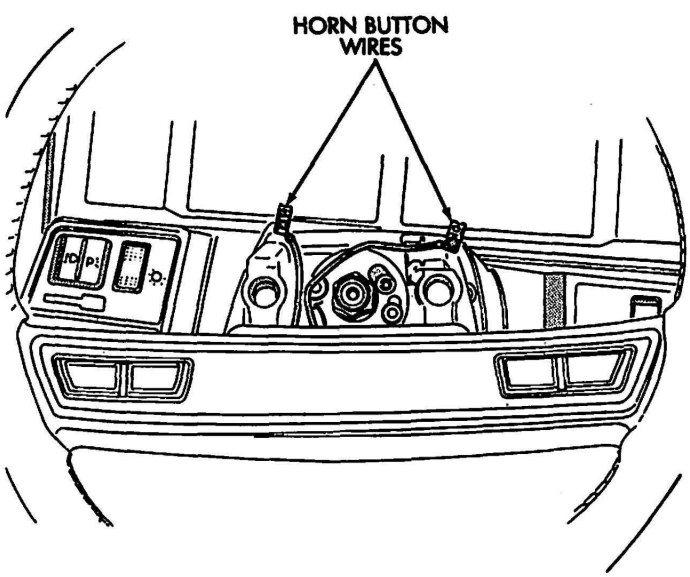


Fig. 4—Disconnect Horn Button Wires

SPEED CONTROL

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DIAGNOSIS	2		

GENERAL

Speed control operation is limited to speeds above 40 km/h (25 mph). At any speed above 40 km/h (25 mph) the system will maintain the selected road speed within 5.6 km/h (3.5 mph). A change greater than 5.6 km/h (3.5 mph) may be experienced with automobiles having an economy axle ratio or when driving on unusually hilly terrain, pulling a trailer, at high altitudes or if engine performance is poor.

To activate the system press the ON switch. Accelerate to the desired speed above 48 km/h (30 mph) and press the set/coast or the resume/accel switch. The system will be activated and the vehicle speed will be maintained. The ON indicator light will illuminate at any time the speed control system is controlling throttle positioning.

If a lower speed is desired while cruising at a selected speed, depress and hold the set/coast switch until the automobile decelerates to the desired speed. When the button is released, the new selected speed will be maintained.

If a higher speed is desired, accelerate to the desired speed, press the set/coast (for less than 1.5 seconds) and release. To achieve an increased cruising speed, press and hold the resume/accel switch (for longer than 1.5 seconds) causing the vehicle to accelerate. When the resume/accel switch is released a new vehicle speed will be set.

WARNING: DO NOT USE THE SPEED CONTROL SYSTEM WHEN DRIVING ON SLIPPERY OR CONGESTED ROADS.

The driver may regain normal control by pressing the OFF button, by pressing the brake pedal or by shifting to neutral. If either the brake or shifting method is used to regain control, the previously selected road speed will be maintained in memory and may be regained by momentarily (less than 1.5 seconds) pressing the resume/accel button. The memory may be erased by pressing the OFF switch or by turning the ignition off.

As a safety feature the speed control system will disengage itself from controlling vehicle speed if it senses too rapid a change in vehicle speed. If vehicle speed changes up or down greater than 5 mph/sec the module will disengage itself. This may happen as a result of driving on ice, accelerating on the downslope of a steep hill or driving through a deep puddle of water.

OPERATION

The selected road speed is maintained by a servo which controls the throttle position according to the module output. Three solenoid-controlled valves are used to control manifold vacuum applied to the servo. In the deactivated state, the charge valve blocks manifold vacuum, while the vent and dump valve admit atmospheric pressure. A spring relaxes the diaphragm and throttle position is unaffected. When the charge valve solenoid is energized, the charge valve is opened and manifold vacuum moves the diaphragm to control the throttle position. Throttle position is maintained for any speed above 40 km/h (25 mph) by balancing the amount of vacuum charge and vacuum vent. The control ground path that accomplishes this is provided by the module. The dump valve is held on all the time unless the brake has been depressed or the speed control system has been turned off.

COMPONENTS

The speed control is a closed loop electromechanical servo system that consists of the following components:

- Speed control module
- Servo
- Speed control switch
- Vacuum storage can and check valve
- Speed sensor module
- Release mechanisms, which consist of the brake lamp switch and the Park/Neutral (auto transmission) switch.

SPEED CONTROL MODULE

The module is sealed by the manufacturer and cannot be serviced internally.

The speed control module receives an input signal that represents vehicle speed from the speed sensor module. The module (located behind the instrument panel) has a low speed circuit that prevents operation below 40 km/h (25 mph).

The module is a sealed black box that contains several circuits.

The speed sensor is a tach-generator that functions as the source for the vehicle speed signal. The signal generated by the speed sensor is applied to the speed sensor module which conditions the signal and passes it to the speed control module. The signal is then applied to the amplifier circuit in the module, which amplifies and shapes it. The amplified voltage is further modified by the frequency-to-DC converter, which transforms the variable DC square wave into a DC voltage that is proportional to the vehicles road speed.

SERVO

The servo (mounted in the engine compartment) is controlled by the speed control module. Manifold vacuum provides the force for diaphragm motion. A cable connects the servo to the throttle linkage.

SPEED SENSOR

The speed sensor is a device located in the transmission that generates a signal in relation to transmission output shaft rotation. This signal is supplied to the speed sensor module which then supplies the speed signal to the odometer, VMM module, trip computer and speed control module.

DIAGNOSIS

Whenever a speed control malfunction occurs, first verify that the speed control wire harness is properly connected to the module before starting normal diagnosis and repair procedures.

A poor connection can cause a complete or intermittent malfunction and is also the only untestable connection in the circuit. For this reason, a loose connection may be misdiagnosed as a module malfunction.

Also, check all vacuum connections for tightness and cracked hoses.

SPEED CONTROL MODULE TEST

The speed control module is the only component of the system that cannot be isolated and tested separately. It must be tested while connected to the other components of the system.

Refer to Electrical Diagnosis.

ELECTRICAL DIAGNOSIS

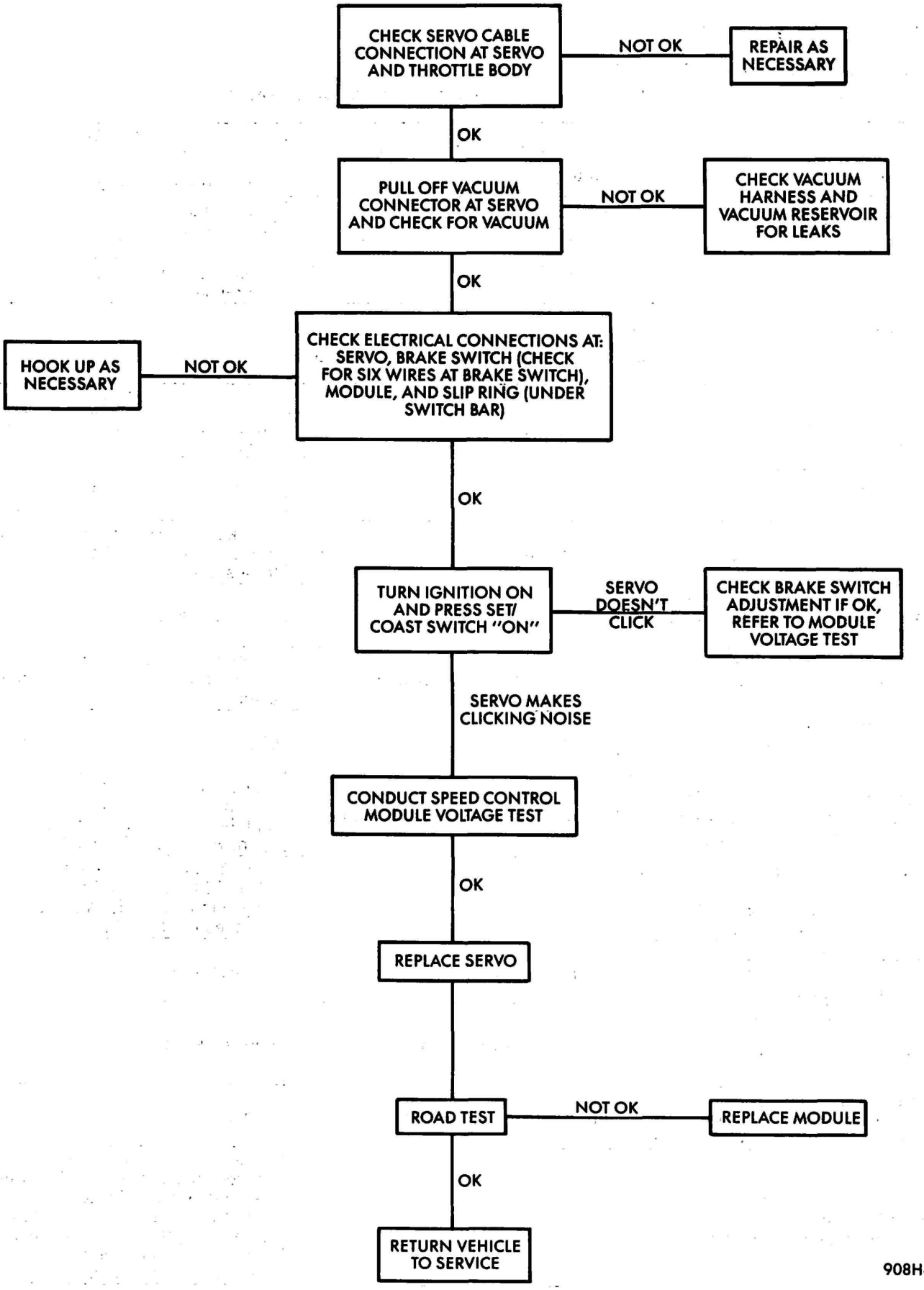
GENERAL INFORMATION

The speed control system operates a mechanical linkage to the throttle by means of a throttle actuator. This is a diaphragm moved by a vacuum applied to one side. A solenoid operated valve connects the throttle actuator to a vacuum tank. Another solenoid valve vents the vacuum to reduce the suction. The speed control module controls the throttle actuator and the throttle by pulsing these solenoid valves on and off.

One input to the module is the vehicle's speed. If the actual speed signal is different from the speed that was set into and remembered by the module, the module generates pulses to change the vacuum and return the vehicle to the set speed. Other inputs to the module are from the speed switch and the set switch.

A disconnect input to the module comes from a switch on the brake pedal. A separate vacuum shutdown of the speed control comes when the brake pedal is depressed and the safety valve solenoid de-energizes.

The two outputs of the module operate the coils of the vacuum valve solenoid and the vent valve solenoid. Both valves are located in the speed control servo. These valves move the throttle by means of the throttle actuator.


CHECK SERVO CABLE CONNECTION AT SERVO AND THROTTLE BODY
NOT OK
REPAIR AS NECESSARY
OK
PULL OFF VACUUM CONNECTOR AT SERVO AND CHECK FOR VACUUM
NOT OK
CHECK VACUUM HARNESS AND VACUUM RESERVOIR FOR LEAKS
OK
CHECK ELECTRICAL CONNECTIONS AT: SERVO, BRAKE SWITCH (CHECK FOR SIX WIRES AT BRAKE SWITCH), MODULE, AND SLIP RING (UNDER SWITCH BAR)
NOT OK
HOOK UP AS NECESSARY
OK
TURN IGNITION ON AND PRESS SET/ COAST SWITCH "ON"
SERVO DOESN'T CLICK
CHECK BRAKE SWITCH ADJUSTMENT IF OK, REFER TO MODULE VOLTAGE TEST
SERVO MAKES CLICKING NOISE
CONDUCT SPEED CONTROL MODULE VOLTAGE TEST
OK
REPLACE SERVO
ROAD TEST
NOT OK
REPLACE MODULE
OK
RETURN VEHICLE TO SERVICE

908H-9

DIAGNOSIS (Fig. 1)

Speed Control Module Voltage Test

Disconnect Speed Control Module Connector, Ignition Switch In ON Position

TEST	OK	NOT OK
Terminal 28	Battery	Check/repair Fuse 10 and wire between terminal 28 and fuse for an open
Measure voltage at Terminal 36	Battery	Check/repair bulb, and wires between fuse and terminal 36 for an open
Measure voltage between Terminal 28 and 24 with gear selector in PARK and NEUTRAL	Battery If OK, go to Resistance Test	Check/repair wires between terminal 28 and 24 for an open and check neutral safety switch

Speed Control Module Resistance Test

Remove Negative Battery Terminal; Disconnect Speed Control Module Connector

TEST	OK	NOT OK
Measure resistance between Terminal 21 and ground	Zero ohms	Check/repair ground circuit for an open
Measure resistance between Terminal 2 of Brake Switch connector and Terminal 34	Zero ohms	Adjust/replace brake switch
Measure resistance between Terminal 2 of Brake Switch connector and Terminal 34	Infinite ohms - with brake depressed	Check/repair wires between terminals 2 and 34 and Stop Lamp Switch for a short
Measure resistance between Terminal 4 of Brake Switch connector and Terminal 35	Zero ohms	Adjust/replace brake switch
Measure resistance between Terminal 4 of Brake Switch connector and Terminal 35	Infinite ohms - with brake depressed	Check/repair wires between terminals 4 and 35 and Stop Lamp Switch for a short
Measure resistance between Terminal 1 of Speed Sensor Module and Terminal 23	Zero ohms	Check/repair circuit for an open
Measure resistance between Terminal 21 and Terminal 26. Turn steering wheel slowly while measuring	Open circuit in all wheel positions	Check/repair circuit between terminals 21 and 26, outer and middle slip rings and brushes for an open. Replace switches if all are OK
Measure resistance between Terminal 21 and Terminal 26 with speed control OFF switch depressed. Turn steering wheel slowly while measuring	Zero ohms	Check/repair circuit between terminals 21 and 26, outer and middle slip rings and brushes for a short. Replace switches if all are OK
Measure resistance between Terminal 21 and Terminal 26 with speed control ON switch depressed	Approximately 680 ohms	Replace switch
Measure resistance between Terminal 21 and Terminal 26 with speed control RESUME/ACCEl switch depressed	Approximately 5.6 K ohms	Replace switch
Measure resistance between Terminal 21 and Terminal 26 with speed control SET/COAST switch depressed	Approximately 2 K ohms	Replace switch
Check continuity of wires and Brake Switch from Speed Control Module connector to Servo connector	Zero ohms	Repair wire and/or Brake Switch as needed. If Wires and Brake Switch are good replace the servo with a known good servo. If speed control operates replace servo. If speed control does not operate replace speed control module.

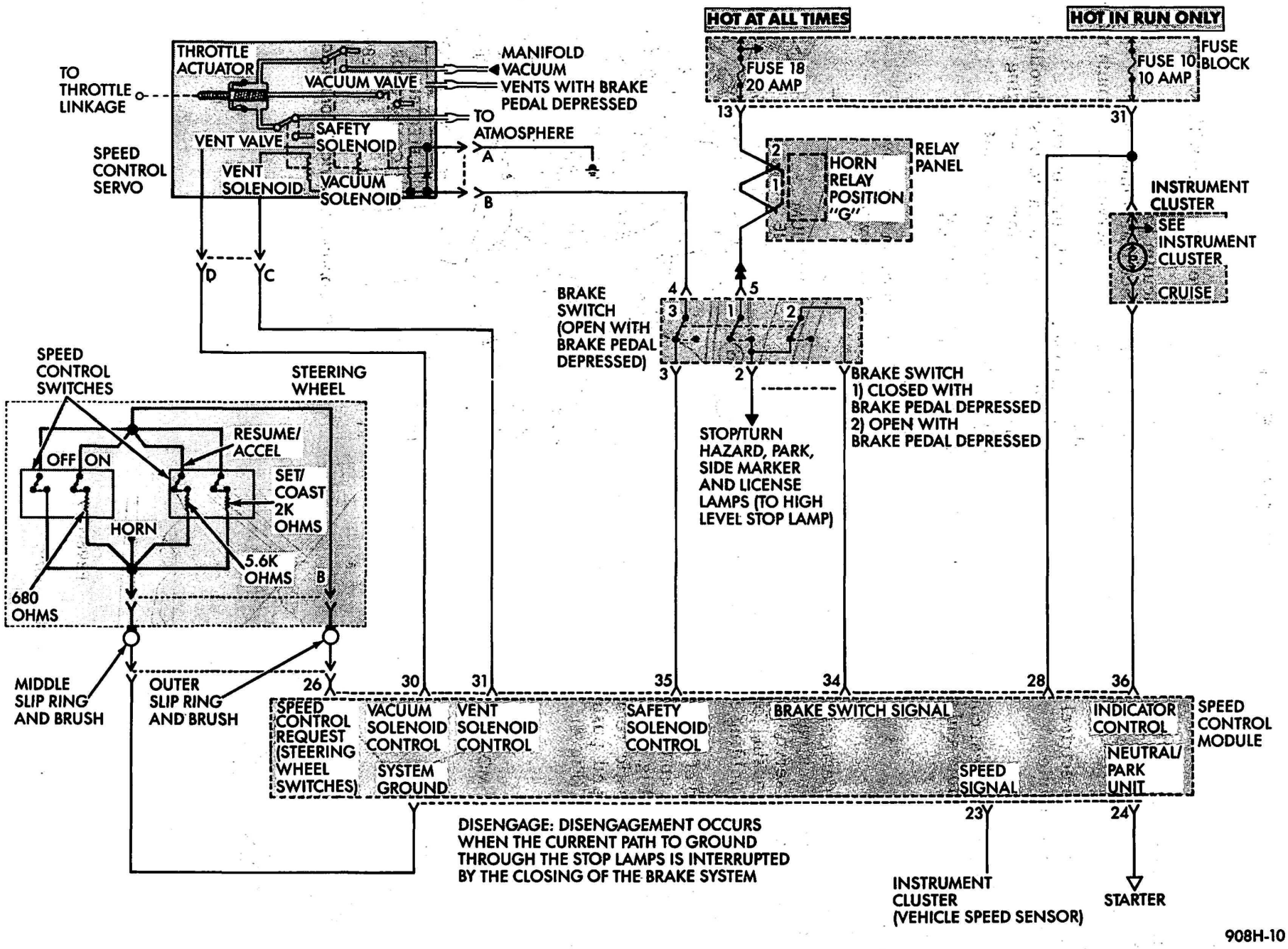


Fig. 1—Speed Control Schematic

COMPONENT SERVICE

MODULE

Removal

The module is located behind the dash panel near the drivers door.

(1) Remove mounting screws from module (Fig. 1).
(2) Disconnect electrical connector.
(3) Remove module.

Installation

(1) Connect electrical connector.
(2) Position module and secure it in place with screws.

SERVO

Removal

(1) Disconnect electrical connector (Fig. 2).
(2) Disconnect vacuum line at servo.
(3) Remove two servo mounting nuts.
(4) Slide cable housing forward to expose cable.
(5) Remove pin holding cable and servo end of servo cable.
(6) Slide the end of the servo cable at the throttle body rearward and separate cable from throttle body linkage (Fig. 3).
(7) Squeeze plastic retaining tabs, on cable mount, together and push end of cable out of mounting bracket (Fig. 4).

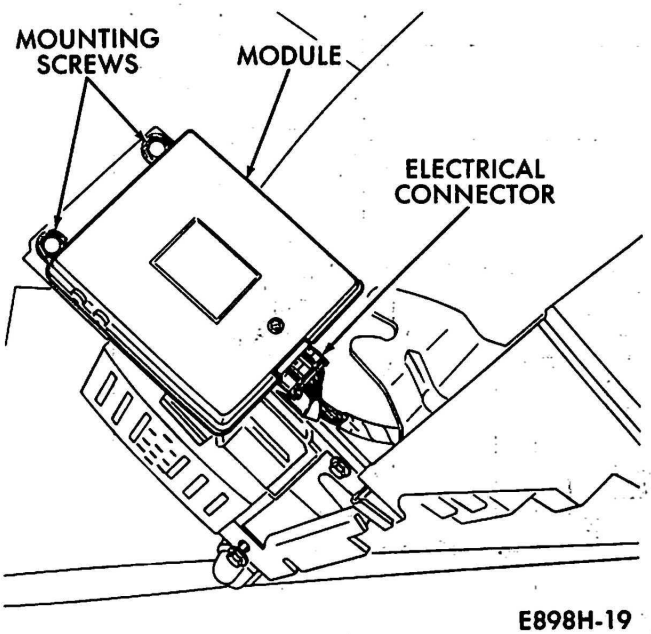


Fig. 1—Speed Control Module Mounting

Installation

(1) Position servo and secure with two nuts (Fig. 2).
(2) Connect vacuum line.
(3) Connect electrical connector.
(4) Pass end of the servo cable through mounting bracket.
(5) Snap servo cable into bracket.
(6) Pull end of servo cable past throttle body linkage and slide it forward engaging linkage into grooves inside cable end piece.

SPEED CONTROL SWITCH

Removal

(1) Pull rearward on horn cover.
(2) Disconnect horn wires.

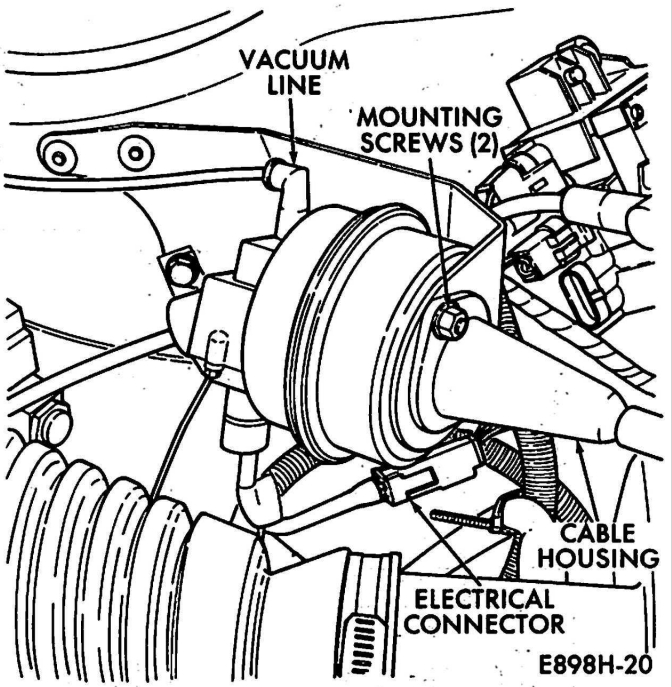


Fig. 2—Disconnect Electrical Connector

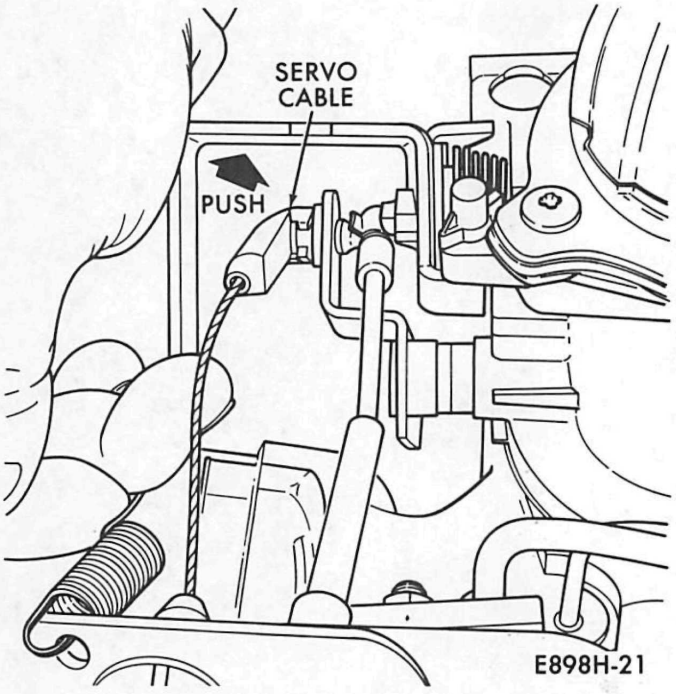


Fig. 3—Slide End of Servo Cable

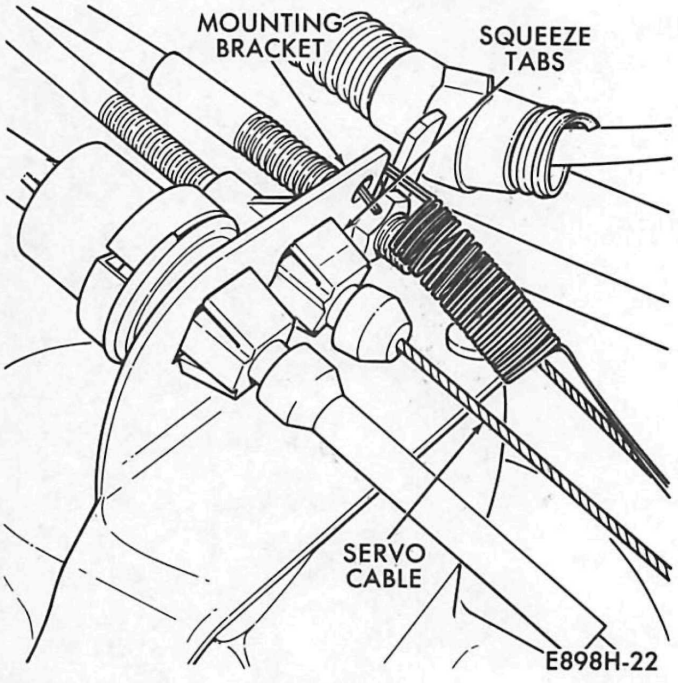


Fig. 4—Remove Servo Cable From Mounting Bracket

(3) Disconnect electrical connector.

(4) Pry up on switch panel (Fig. 5) and remove the panel from the steering wheel.

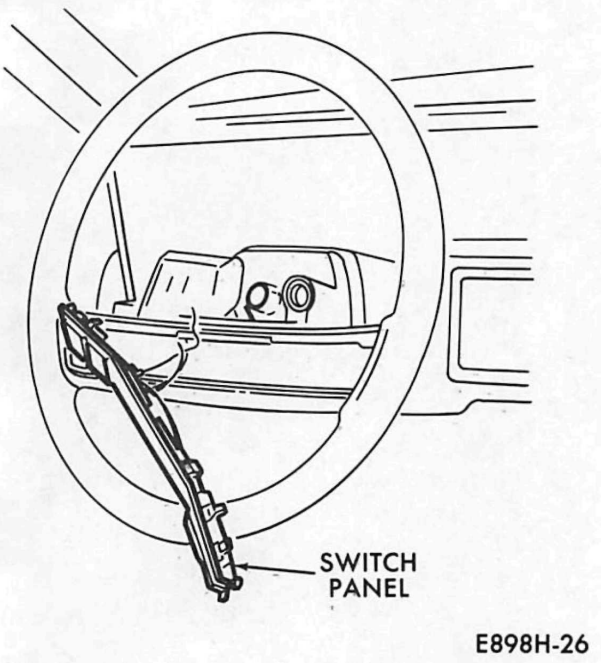


Fig. 5—Remove Switch Panel

Installation

(1) Pass wires on switches through steering wheel and connect.

(2) Snap switch panel in place.

(3) Connect horn wires.

(4) Snap horn cover in place.

TURN SIGNALS AND FLASHERS

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TURN SIGNAL DIAGNOSIS	1	TURN SIGNAL CANCEL SWITCH REMOVAL AND INSTALLATION	5, 6

HAZARD FLASHERS DIAGNOSIS

GENERAL INFORMATION

When the hazard switch is in the ON position, ground is applied to the lamp module. The lamp module will flash both turn signal indicators in the instrument cluster, the front turn signal lamps and the rear turn signal lamps. The signal for the rear turn signals passes through the lamp outage module, which is a current sensing conductive path.

Hazard Lamps Inoperative But Turn Signals Operate

Hazard Switch In The On Position

TEST	OK	NOT OK
Hazard Switch connector - Terminal B	Zero ohms	Repair open to ground
Hazard Switch connector - Terminal A	Zero ohms	Replace hazard switch
Lamp Module connector - Terminal D1	Zero ohms If OK, replace the lamp module	Repair open to hazard switch

TURN SIGNAL DIAGNOSIS

GENERAL INFORMATION

When the turn signal switch in the Left Hand module assembly is in the LEFT or RIGHT position, ground is applied to the lamp module. The lamp module will flash the right or left turn signal indicator in the instrument cluster, front turn signal lamp and rear turn signal lamp. The signal for the rear turn signal passes through the lamp outage module, which is a current sensing conductive path. Fuse 12 supplies battery voltage to the Left Hand front turn signal lamp, the Left Hand front side marker lamp and the lamp outage module. Fuse 20 supplies battery voltage to the Right Hand front turn signal lamp, the Right Hand front side marker lamp, and the license lamp.

TURN SIGNAL LAMPS INOPERATIVE

Ignition In RUN, Turn Signal Switch ON

TEST	OK	NOT OK
LH Module Assembly connector - Terminal D	Zero ohms	Repair open to ground
LH Module Assembly connector - Terminals H and B - Lamp Module disconnected	Zero ohms	Replace LH module assembly
LH Module Assembly connector - Terminals E and F - Lamp Module connected	Zero ohms	Replace LH module assembly
Lamp Module connector - Terminals D3 and D4 - Lamp Module disconnected	Zero ohms	Repair open to LH module assembly
Lamp Module connector - Terminals C4 and C5 - Lamp Module connected	Zero ohms	Repair open to LH module assembly
Lamp Module connector - Terminal C16 - Lamp Module disconnected	Battery voltage (pulsating)	Replace lamp module
Lamp Module connector - Terminal D11 - Lamp Module connected	Battery voltage (pulsating)	Replace lamp module
Insert a voltmeter in place of the turn signal bulb(s)	Battery voltage (pulsating). If OK, replace bulb(s)	Check circuits connected to the bulbs, the lamp outage module, and the lamp control module. If all circuits are good, replace the lamp outage module with a known good lamp outage module. Replace the lamp outage module. If lamps do not operate, replace the lamp control module.

TURN SIGNAL/WIPER/LIGHTS SWITCH

Removal

(1) Disconnect battery negative cable.

(2) Remove screws and instrument panel lower cover if equipped (Fig. 1).

(3) Remove screws (Fig. 2) and remove support bar.

(4) Pull air duct (Fig. 2) out of the way.

(5) Remove tie straps (Fig. 3).

(6) Loosen holddown nut in center of steering column connector (Fig. 4).

(7) Separate the steering column connector.

(8) Separate the signal/wiper/lights switch connector (Fig. 5) from the steering column connector by placing a flat blade screwdriver between the connectors to disengage locking tab. Push on the wire side of the left hand switch (headlight) pod connector and slide the connector out of the channels of the steering column connector.

(9) Disconnect connector (Fig. 6).

(10) Remove the bottom two retaining screws from the left hand switch pod assembly (Fig. 7).

(11) Remove screws from the back of the left hand switch pod assembly, and remove the switch pod housing back cover.

There are small retaining clips on the left hand switch pod that may fall off when the switch is removed.

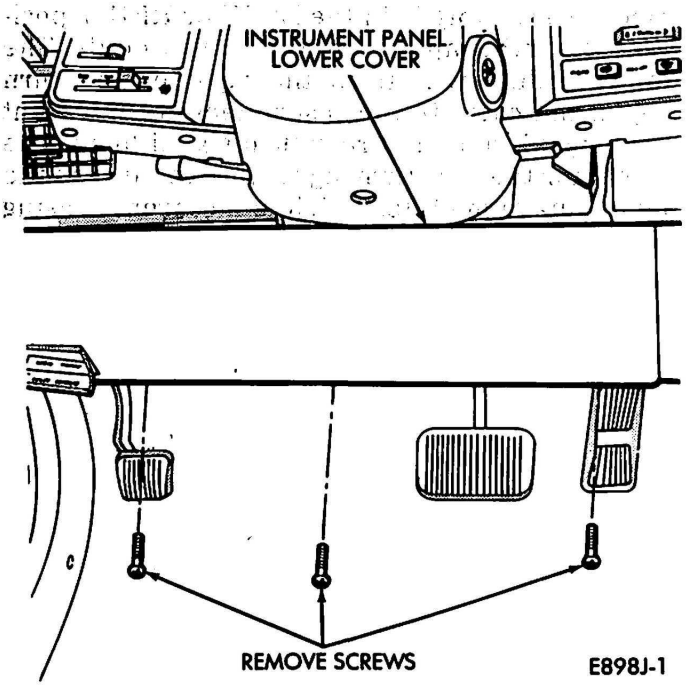


Fig. 1—Remove Instrument Panel Lower Cover

(12) Carefully pull the switch pod far enough from the housing to expose the two screws (Fig. 8).

(13) Remove screws (Fig. 8).

(14) Gently pull switch forward and pull harness out through the housing to remove the switch.

Installation

There are small retaining clips on the left hand and right hand switch pods that must be in place when the switch pods are installed.

(1) Route headlight module connector end of harness through the housing and along underside of steering column.

(2) Connector electrical connector (Fig. 6).

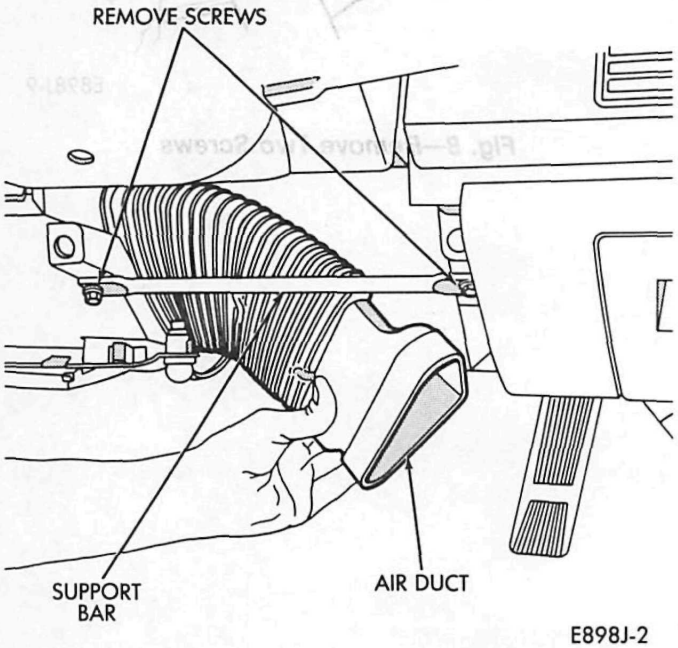


Fig. 2—Remove Support Bar

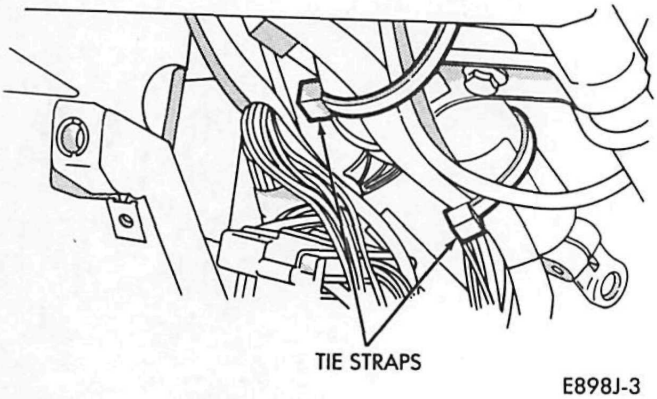


Fig. 3—Remove Tie Straps

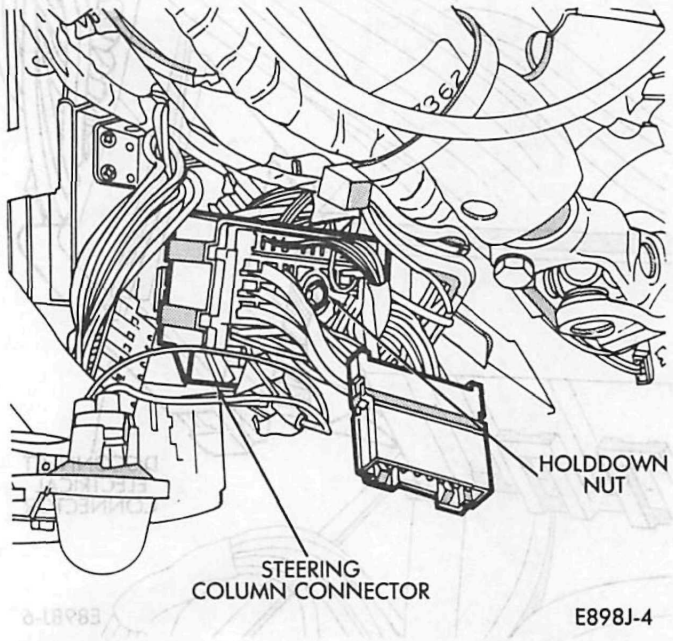


Fig. 4—Loosen Holddown Nut

(3) Slide switch pod connector into steering column connector.

(4) Position steering column connector and tighten holddown nut in center of connector.

(5) Tie strap harness to column.

(6) Position housing back and secure with screws.

(7) Position the switch pod into the housing and secure with screws (Fig. 7).

(8) Connect air duct.

(9) Install support bar.

(10) Position lower instrument panel cover and secure with screws.

(11) Install battery negative cable.

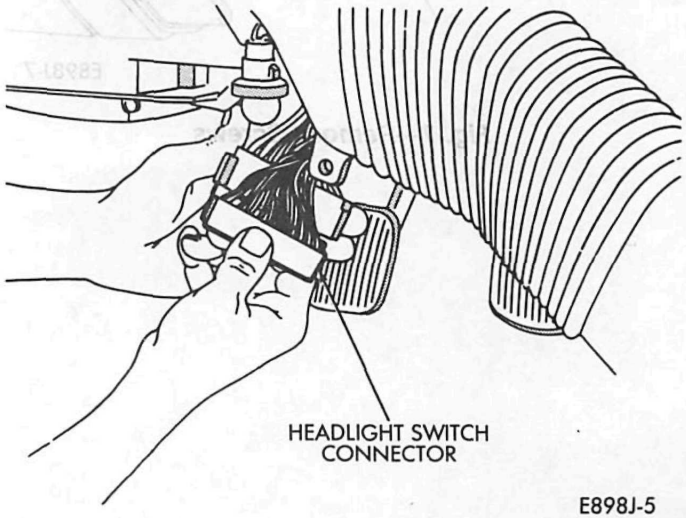


Fig. 5—Signal/Wiper/Lights Switch Connector

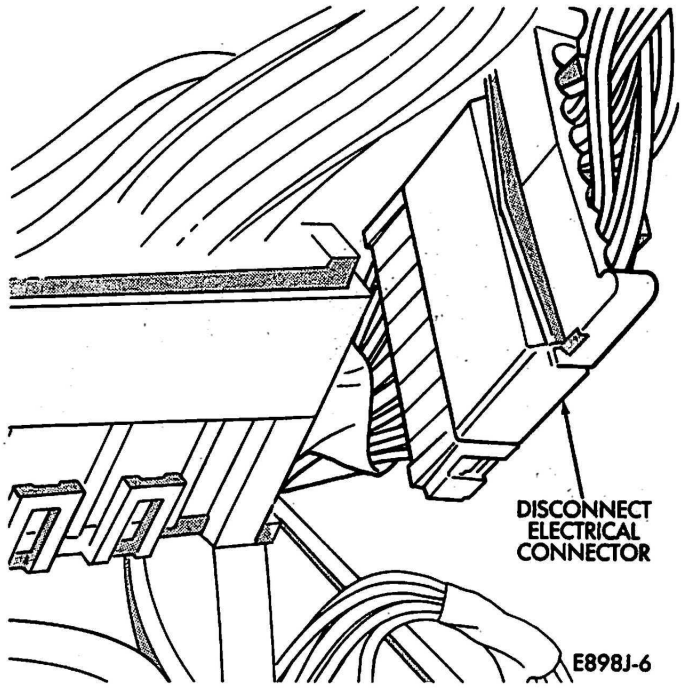


Fig. 6—Disconnect Electrical Connector

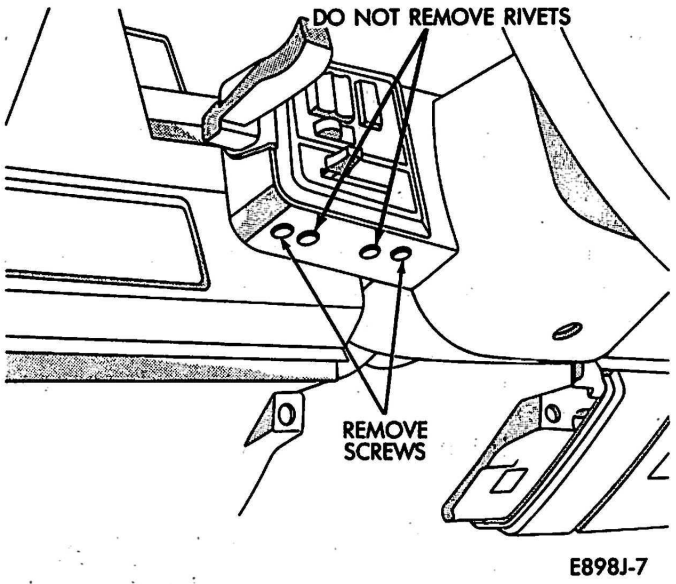


Fig. 7—Remove Screws

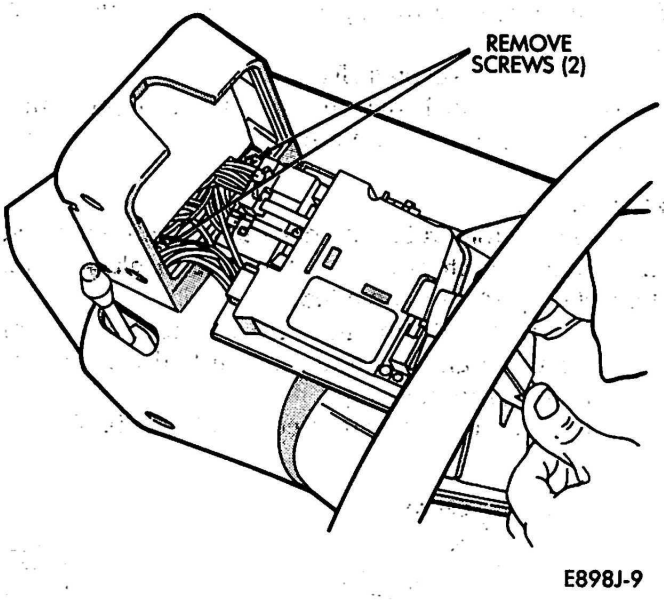


Fig. 8—Remove Two Screws

TURN SIGNAL CANCEL SWITCH

Removal

(1) Remove screws and instrument panel lower cover if equipped (Fig. 1).

(2) Unsnap the horn pad (Fig. 2).

(3) Disconnect wires (Fig. 2) and remove the horn pad.

(4) Note position of the reference mark (Fig. 2) on the end of the steering shaft.

It is not necessary to use a puller to remove the steering wheel from the shaft.

(5) Remove the steering wheel nut (Fig. 2) and slide the steering wheel off the shaft.

(6) Disconnect electrical connector (Fig. 3) and remove the steering wheel.

(7) Remove turn signal cancel cam (Fig. 4) by unhooking tabs and sliding cancel cam off steering column.

Three small bent paper clips may be used to hold the tabs away from the shaft while sliding the cam off.

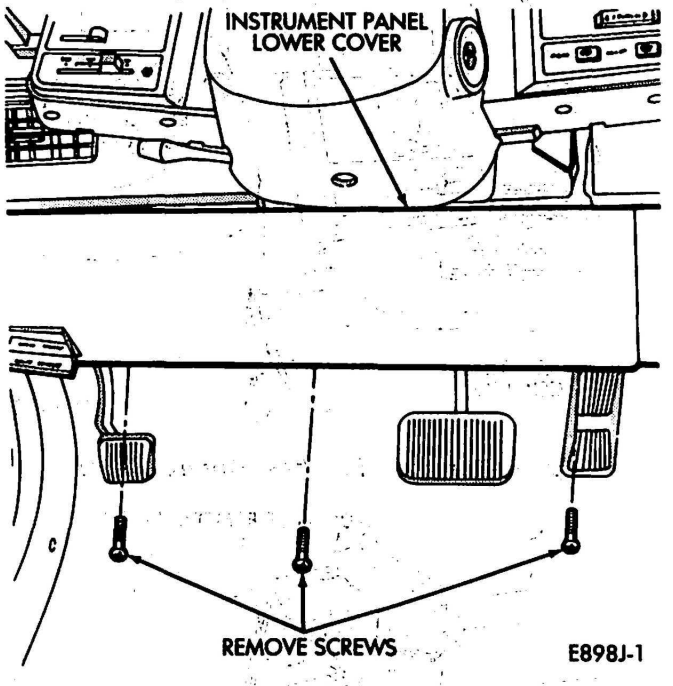


Fig. 1—Remove Instrument Panel Lower Cover

(8) If vehicle is equipped with tilt wheel remove tilt wheel control lever (Fig. 5).

(9) Remove the bottom two retaining screws from the left hand switch pod assembly (Fig. 6).

(10) Remove screws from the back of the left hand switch pod assembly, and remove the switch pod housing back cover.

There are small retaining clips on the left hand switch pod that may fall off when the switch is removed.

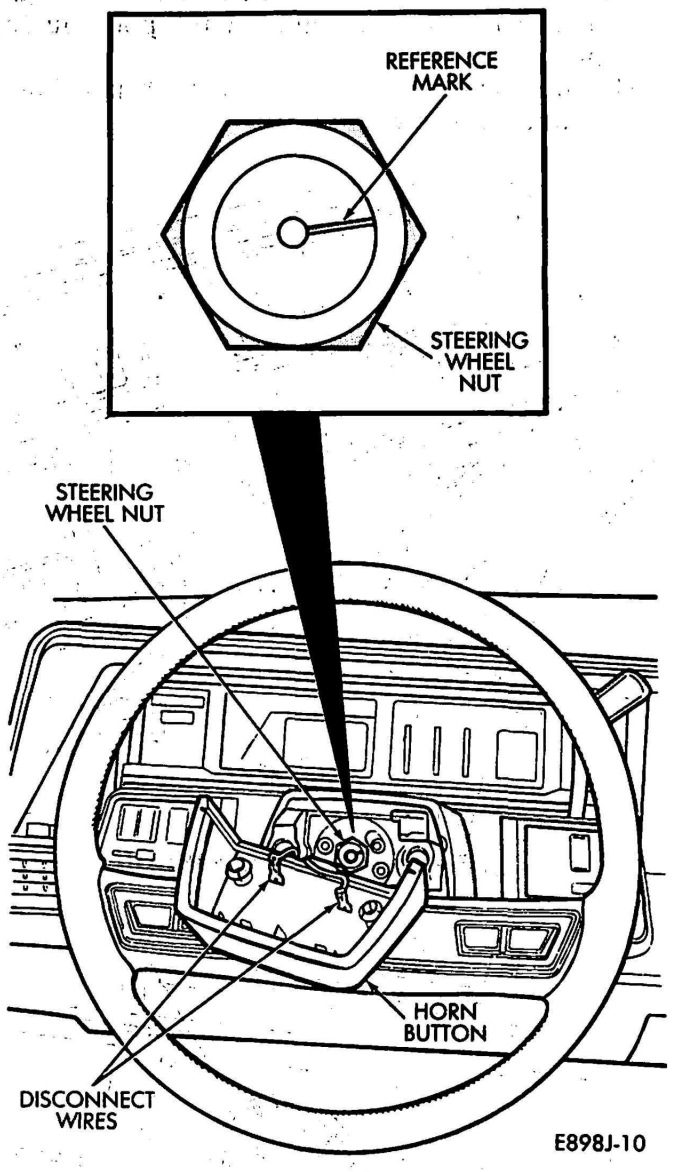


Fig. 2—Remove Horn Button and Steering Wheel

(11) Remove the bottom two retaining screws from the right hand (Heat/AC) switch pod assembly (Fig. 7).

(12) Remove screws from the back of the right hand switch pod assembly, and remove the switch pod housing back cover.

(13) Carefully pull the switch pod assemblies far enough from the housing to expose the housing mounting screws (Figs. 9, 10).

(14) Remove ignition switch trim ring (Fig. 8) by prying it away from the switch pod housing.

(15) Remove two left hand switch pod housing mounting screws (Fig. 9).

(16) Remove two right hand switch pod housing mounting screws (Fig. 10).

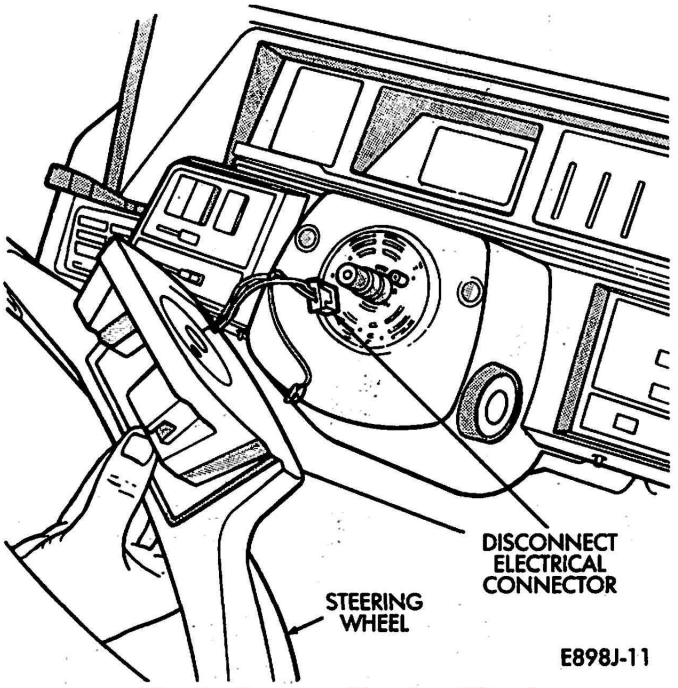


Fig. 3—Remove Steering Wheel

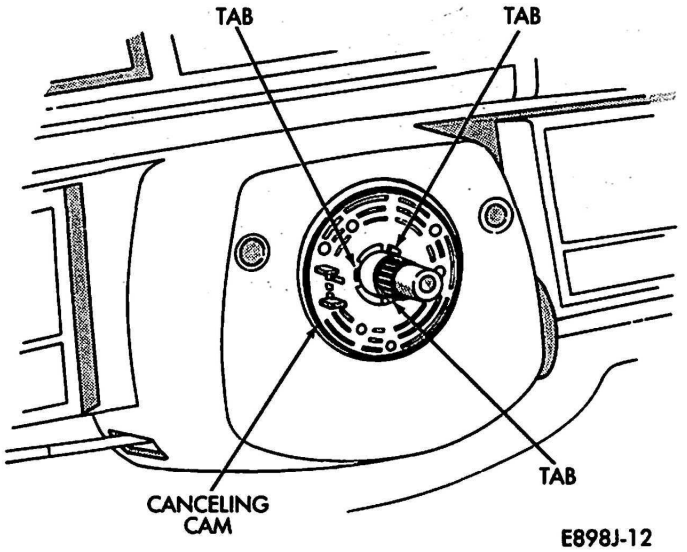


Fig. 4—Remove Turn Signal Cancel Cam

(17) Pass both switch pod assemblies through the back openings in the switch pod housing.

(18) Remove screw holding lower column shroud (Fig. 11).

(19) Separate and remove the lower column shroud.

(20) Remove two screws (Fig. 12) and remove upper column shroud.

(21) Remove screws (Fig. 13) to free turn signal cancel switch.

(22) Disconnect cancel switch connector (Fig. 14).

(23) Remove turn signal cancel switch.

Installation

There are small retaining clips on the left hand and right hand switch pods that must be in place when the switch pods are installed.

(1) To install the turn signal cancel cam, reverse the removal procedures.

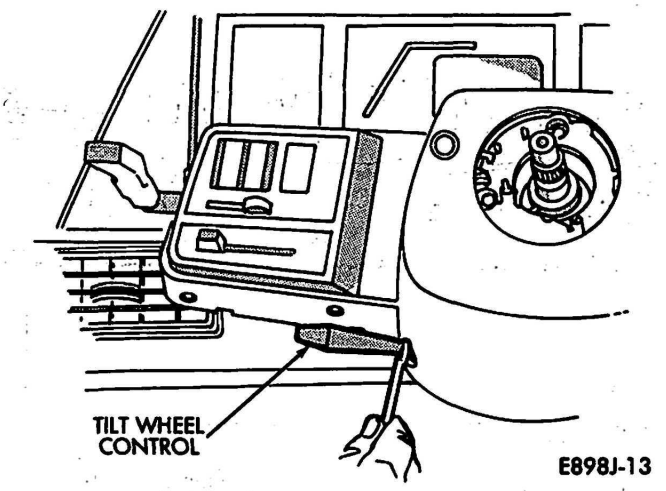


Fig. 5—Remove Tilt Wheel Control Lever

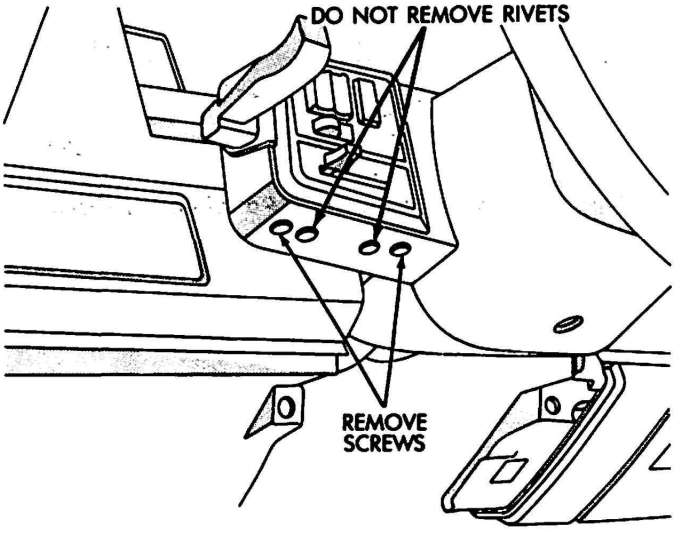


Fig. 6—Remove Screws

(2) Align the pin (Fig. 15) on the turn signal cam with the pin bore in the steering wheel and start the wheel onto the steering shaft.

(3) Align the steering wheel with the reference mark on the steering shaft and seat the wheel on the shaft.

(4) Install and tighten the steering wheel nut to 70 N·m (52 ft. lbs.) torque.

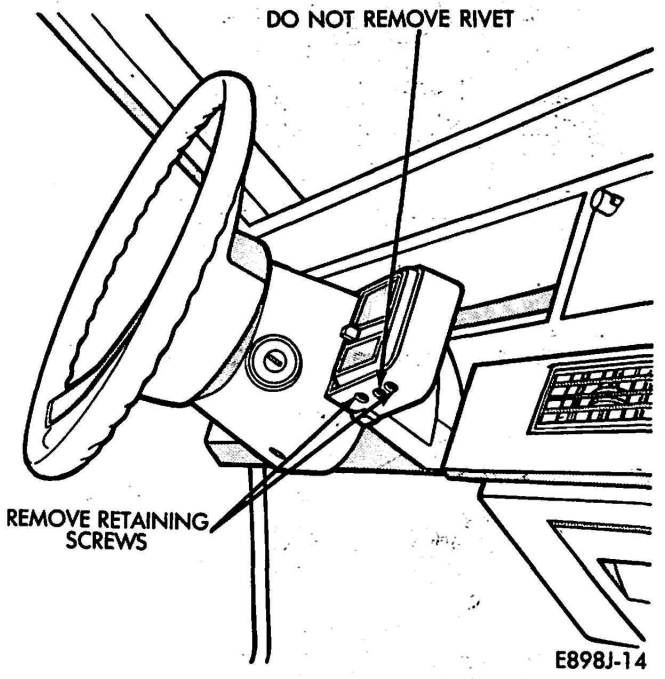


Fig. 7—Remove Right Hand Switch Pod (Heat/AC) Retaining Screws

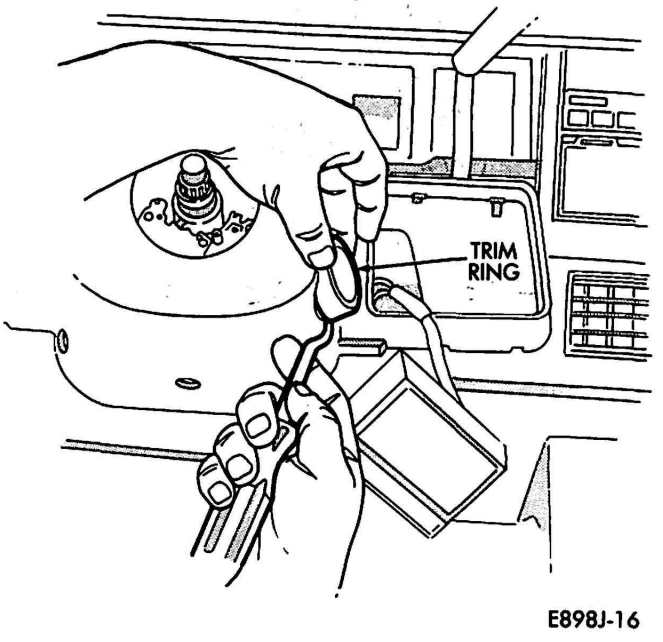


Fig. 8—Remove Ignition Switch Trim Ring

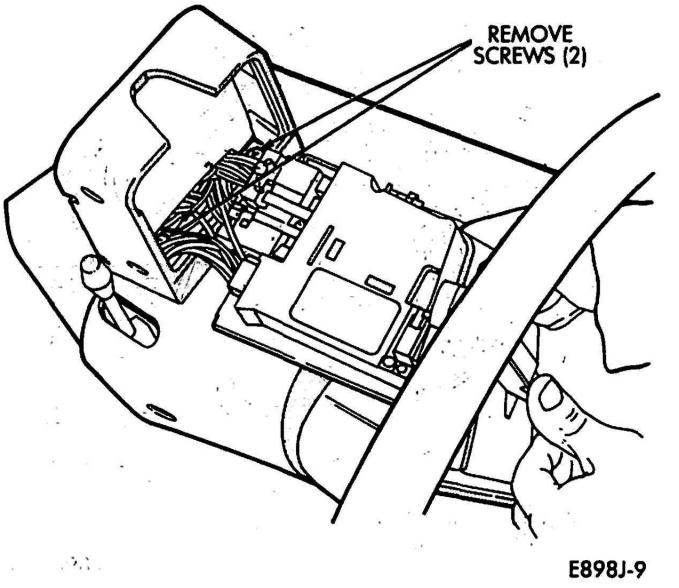


Fig. 9—Remove Two Screws

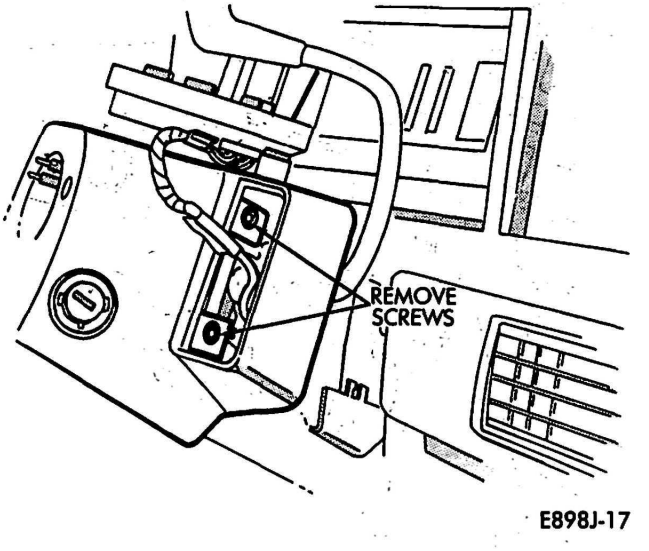


Fig. 10—Remove Two Screws

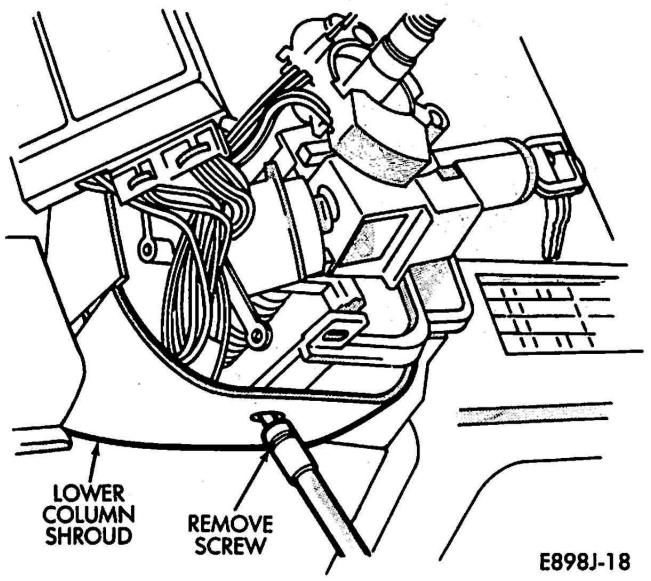


Fig. 11—Remove Lower Shroud Screw

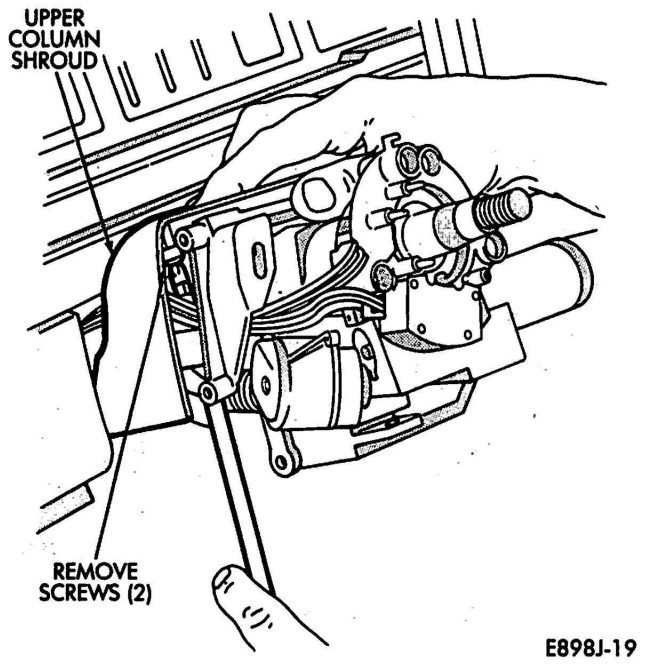


Fig. 12—Remove Two Upper Shroud Screws

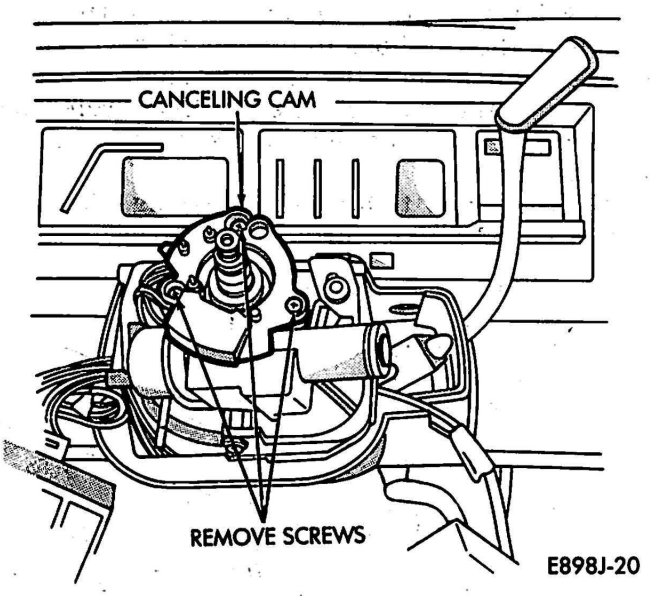


Fig. 13—Remove Cancel Cam Screws

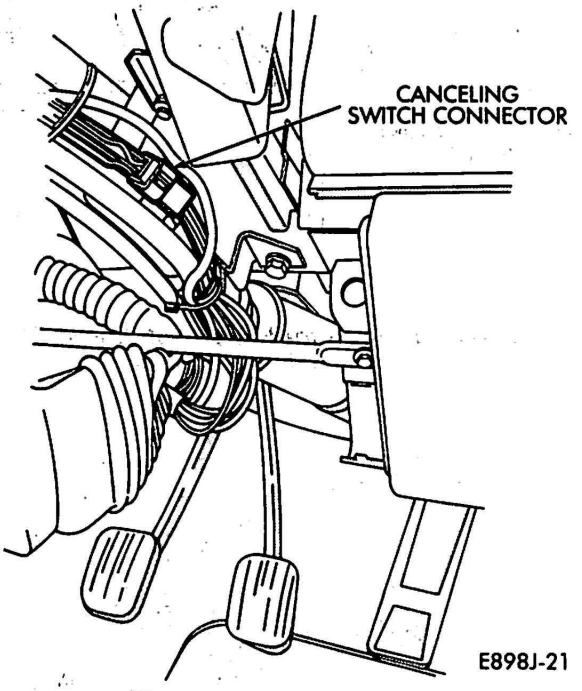


Fig. 14—Disconnect Canceling Switch Connector

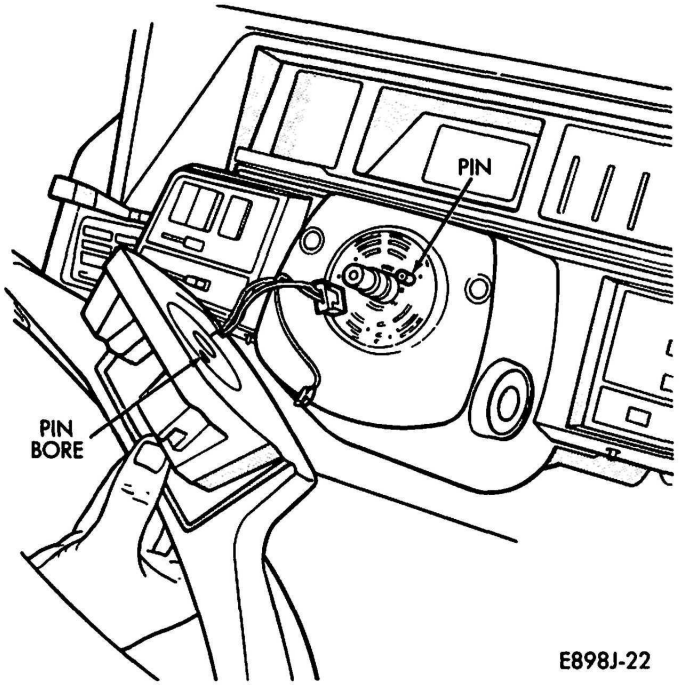


Fig. 15—Steering Wheel Alignment

WINDSHIELD WIPERS

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WINDSHIELD WASHER PUMP	9		

GENERAL INFORMATION

The two-speed intermittent electric windshield wipers and electric washers are standard equipment. The intermittent part of the wiper system provides an adjustable pause between wipe cycles for use during conditions of slight precipitation.

The controls for the windshield wipers are part of the control switch module mounted on the left hand switch pod located on the left side of the steering column.

The electric wipers are operated by moving the wipe switch slide lever to the far right. For intermittent operation move the wiper switch slide lever slightly to the right to the desired intermittent position.

To activate the washer system, push the wiper switch lever knob in.

Activating the washer also turns the wiper on.

CAUTION: The wiper arms and blades must not be moved manually from side to side or damage could result.

DIAGNOSIS

DIAGNOSIS (Figs. 1, 2, 3, 4, 5)

Intermittent wiper/washer circuit contains four major components - wiper switch, wiper module, wiper motor, and washer pump.

The intermittent wiper/washer is supplied with power from circuit breaker 24, which supplies voltage to the wiper switch, washer switch and the module.

The wiper operates by placing the wiper switch slide lever in HI, LO, INT or WASH position. When the wiper switch is positioned on HI, current flows from the fuse block through the switch to the HI speed brush of the motor. When the wiper switch is turned to INT, current flows from the fuse block through the switch and then to the wiper module. The timer in the intermittent wiper module momentarily applies battery voltage to the LO speed brush of the wiper motor and the motor completes one wipe cycle. The time between wipes is controlled by a rheostat in the wiper switch.

A PARK/WIPE switch in the wiper motor gear box is driven by the wiper motor. The switch provides ground to the wiper module after the wiper switch slide lever is moved to the off position.

1. *Windshield Wipers Inoperative*
IGNITION SWITCH IN RUN, WIPER SWITCH IN LO OR HI POSITION

TEST	OK	NOT OK
Inspect Circuit Breaker 24	Not blown	Replace Circuit Breaker 24
Battery side of circuit breaker	Battery voltage	Repair open from ignition switch
Connector A - Terminal S	Battery voltage	Repair open from Circuit Breaker 24
Connector B - Terminal S Wiper Switch in HI	Battery voltage	Replace LH module
Connector C - Terminal S Wiper Switch in LO	Battery voltage	Replace LH module
Connector D - Terminal D to ground	Wiper motor does not run. Go to next step	Wiper motor runs. Check circuit for an open. If circuit is good go to intermittent wiper module test
Connector D - Terminal E Wiper Switch in HI	Battery voltage. If OK, replace wiper motor	Repair open from wiper switch in LH module
Connector D - Terminal F Wiper Switch in LO	Battery voltage. If OK, replace wiper motor	Repair open from wiper switch in LH module

2. *Windshield Wipers Inoperative in INT, OK in HI and LO*
IGNITION SWITCH IN RUN, WIPER SWITCH IN INT.

TEST	OK	NOT OK
Connector E - Terminal J Wiper module disconnected	Zero ohms	Repair open to ground
Connector E - Terminal H	Battery voltage	Repair open from Circuit Breaker 24
Connector E - Terminal D	Battery voltage	Go to wiper switch test
Connector E - Terminal C	Battery voltage	Replace intermittent wiper module
Connector F - Terminal S	Battery voltage. If OK, repair open to intermittent wiper module	Replace LH module
Connector G - Terminal S	Battery voltage. If OK, replace LH module	Repair open from intermittent wiper module

3. *Windshield Wipers Do Not Park*

TEST	OK	NOT OK
Connector D - Terminal C	Zero ohms	Repair open to ground
Connector E - Terminal J	Zero ohms. Replace intermittent wiper module	Repair open between wiper motor and intermittent wiper module. If OK, replace wiper motor

4. *Windshield Washers Inoperative*
IGNITION IN RUN, WIPER SWITCH IN WASH

TEST	OK	NOT OK
Connector G - Terminal S	Battery voltage	Replace LH module
Washer Pump Motor connector - Terminal A	Battery voltage	Repair open from wiper switch
Washer Pump Motor connector - Terminal B Washer switch OFF	Zero ohms. If zero ohms, replace washer pump motor	Repair open to ground

5. *Windshield Wipers Inoperative During Washer Operation*
IGNITION IN RUN, WIPER SWITCH IN WASH

TEST	OK	NOT OK
Connector E - Terminal K	Battery voltage. If OK, replace intermittent wiper module	Repair open from LH module

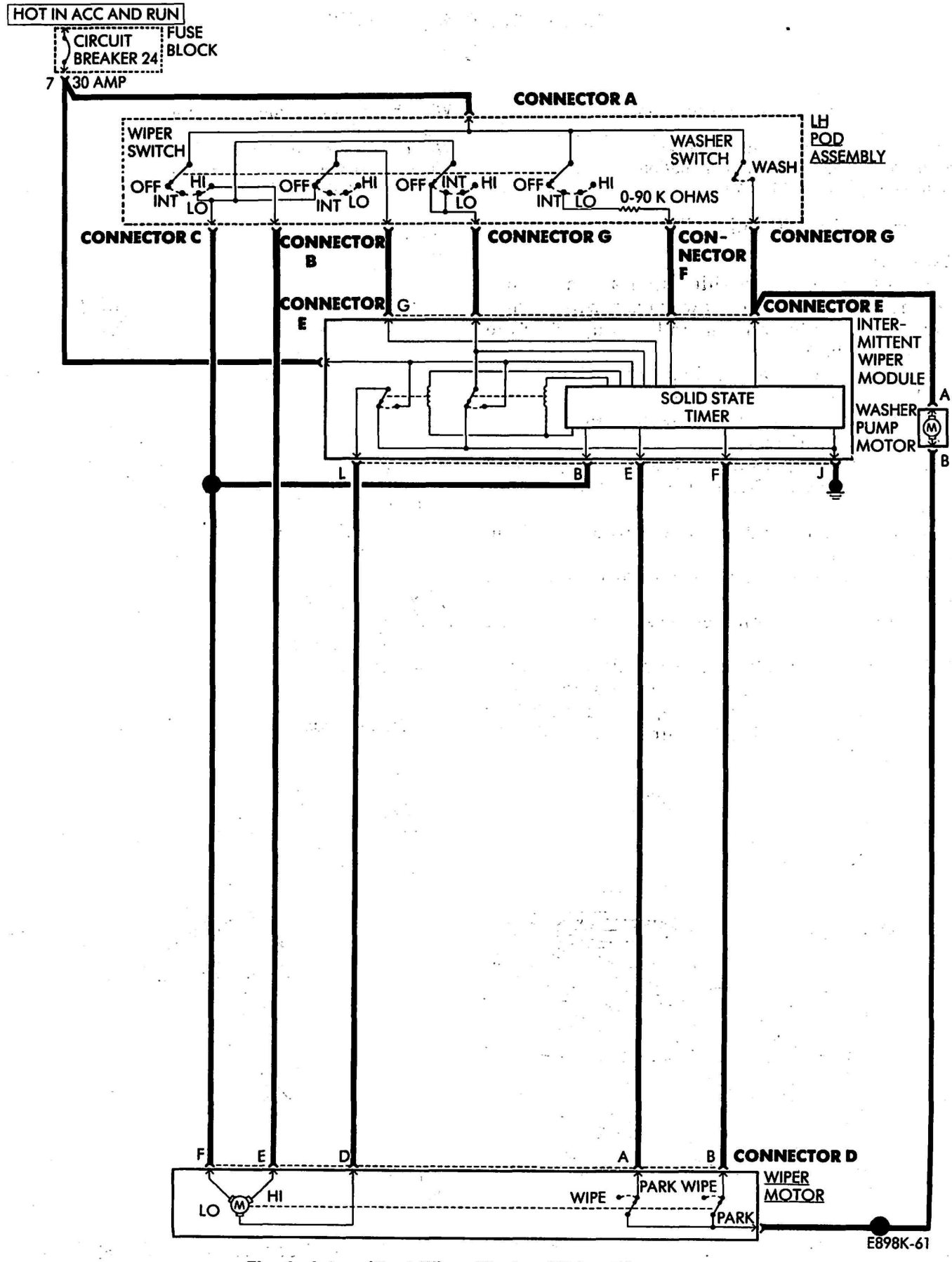


Fig. 1—Intermittent Wiper Washer Wiring Diagram

SERVICE PROCEDURES

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MOTOR/DEPRESSED PARK LINK

Removal

(1) Lift up on drivers side wiper arm and move retainer tab (Fig. 1) fully away from wiper arm.

(2) Grasp blade and arm and pull up off of the wiper arm shaft.

(3) Disconnect washer hose on drivers side blade from connector (Fig. 2).

(4) Disconnect washer hose on center blade from connector (Fig. 3).

(5) Lift up on passenger side wiper arm and move retainer tab (Fig. 1) fully away from wiper arm.

(6) Grasp blade and arm and pull up off of the wiper arm shaft.

(7) Remove cowl screen holddown bolts (Fig. 4).

(8) Turn cowl screen locking screws (Fig. 6) 1/4 turn.

(9) Remove the left screen by sliding towards rear of car, from underneath the weatherstrip.

(10) Remove ball end of depressed park link (Fig. 6) using a suitable fork under the link, lifting upward.

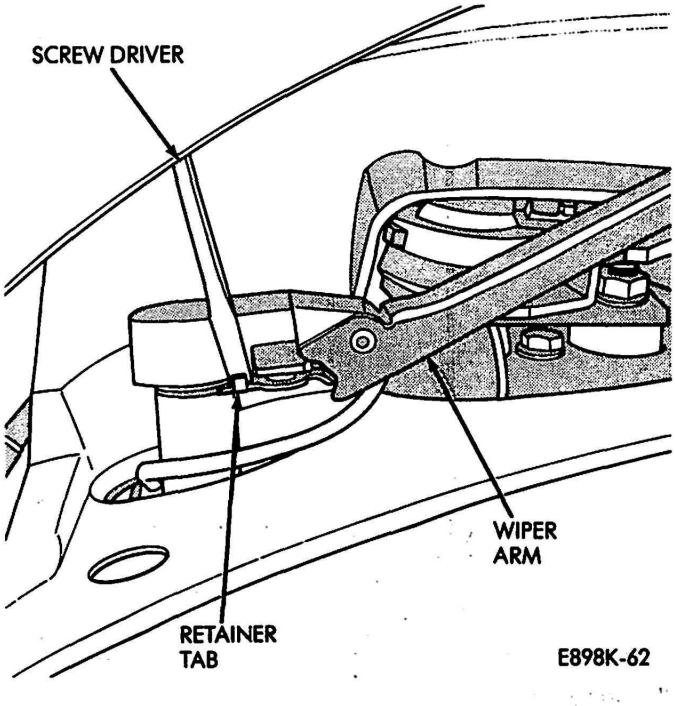


Fig. 1—Release Wiper Arm Retainer Tab

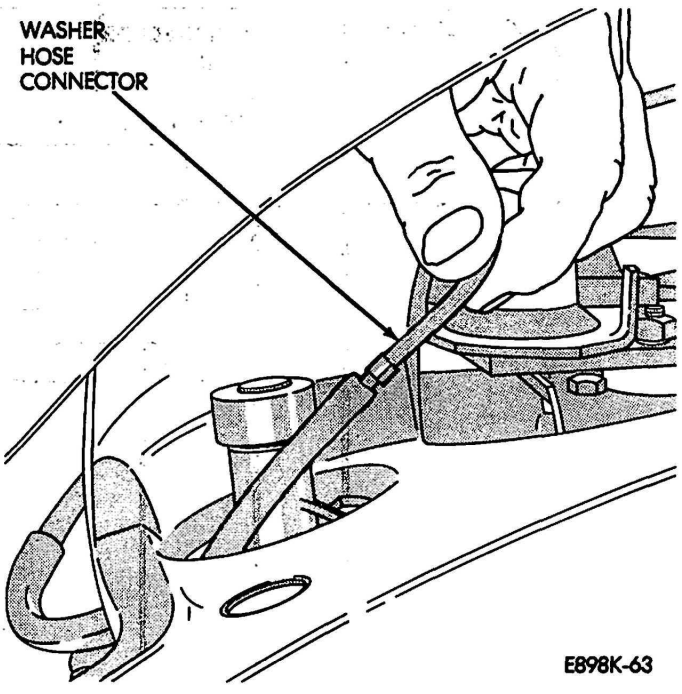


Fig. 2—Disconnect Washer Hose Drivers Side

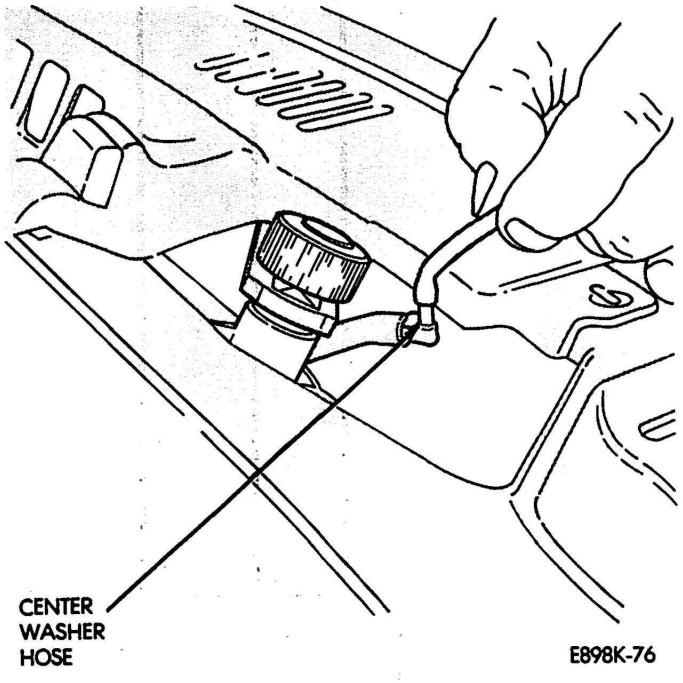


Fig. 3—Disconnect Center Washer Hose

(11) Move the depressed park link to the right (Maximum of 90° to right), to make the nut visible (Fig. 6).

(12) Hold the motor crank arm with one hand and remove center shaft locknut and spacer with an open end wrench.

CAUTION: DO NOT hit the shaft or crank arm as damage can occur to the internal mechanism of the motor shaft.

(13) Carefully remove motor crank arm from the shaft and remove the depressed park link.

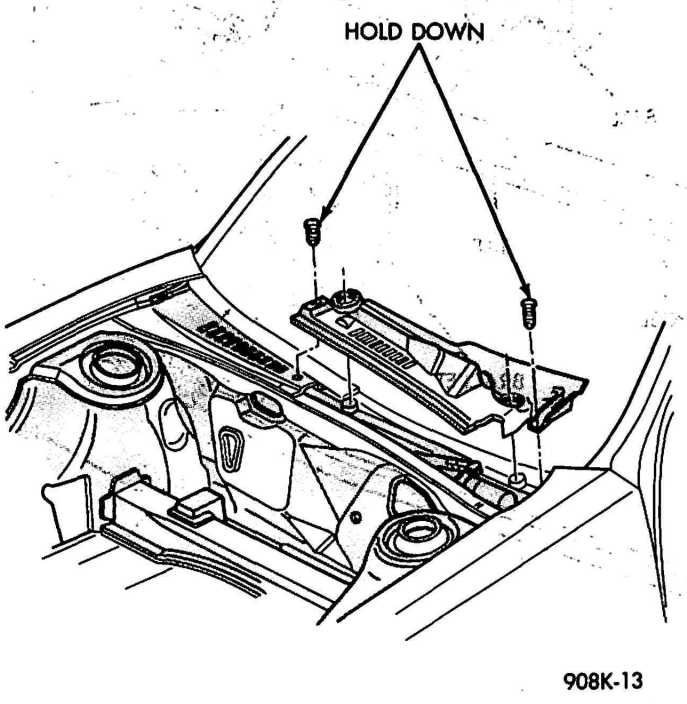


Fig. 4—Cowl Screen Holddown Bolts

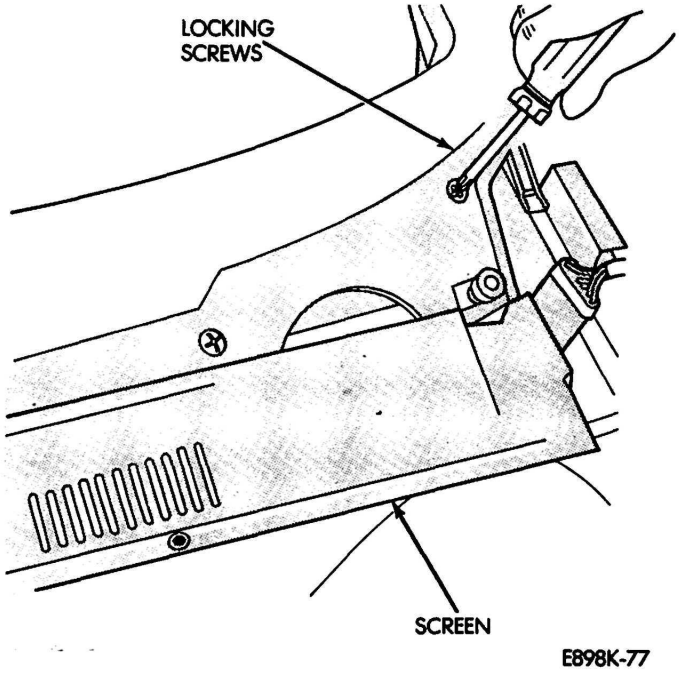


Fig. 5—Unlock Cowl Screen Attaching Screws

(14) If the motor is to be removed, remove three mounting bolts (Fig. 6).

(15) Disconnect electrical connector.

(16) Remove motor.

Installation

(1) Install new motor to bracket with three mounting bolts tightened to 9-11 N·m (6.5-8 ft. lbs.) torque.

(2) Connect electrical connector.

(3) Cycle the motor by activating the wiper switch inside the vehicle. Make sure the switch is in the OFF position before turning off the ignition.

(4) Place the depressed park link over the motor shaft. DO NOT push the link onto the shaft. The link should be in the "Park" position before installation (the forks should be at the farthest point from the cam mechanism). To check, turn crank arm clockwise approximately 1/2 turn, then counterclockwise until the forks move to the farthest point away from the round cam mechanism. (Move crank arm far enough to provide access for installing the motor crank nut and spacer). Do not move clockwise again.

(5) Place the opposite end over the ball. DO NOT snap the link onto the ball.

(6) Start the nut and washer on the motor. DO NOT tighten the nut.

(7) Line up the depressed park link and the crank arm as shown (Fig. 7).

(8) Carefully move the depressed park link to the right so the nut is exposed.

CAUTION: Nut must be tightened to correct torque or the shaft may be damaged.

(9) Tighten nut to 20-25 N·m (14.5-18 ft. lbs.).

CAUTION: Be careful not to damage the cap when snapping it over the ball. Use a shop towel or a suitable material.

(10) Place the other end of the depressed park link over the ball.

(11) Cycle wiper motor, using wiper switch, through one complete cycle. Bring it to the OFF position before turning off ignition. Check again for proper alignment of the depressed park link and the crank arm. If alignment is incorrect remove depressed park link and repeat procedures.

(12) Install left screen by tucking under weatherstrip and securing all fasteners.

(13) Install screen holddown screws.

(14) Inspect weatherstrip to ensure full engagement to upper lip of dash panel.

(15) Connect the center washer hose to hose on wiper arm (Fig. 3).

(16) Install the center wiper arm onto the shaft orienting it so that the arm is over the rubber stop.

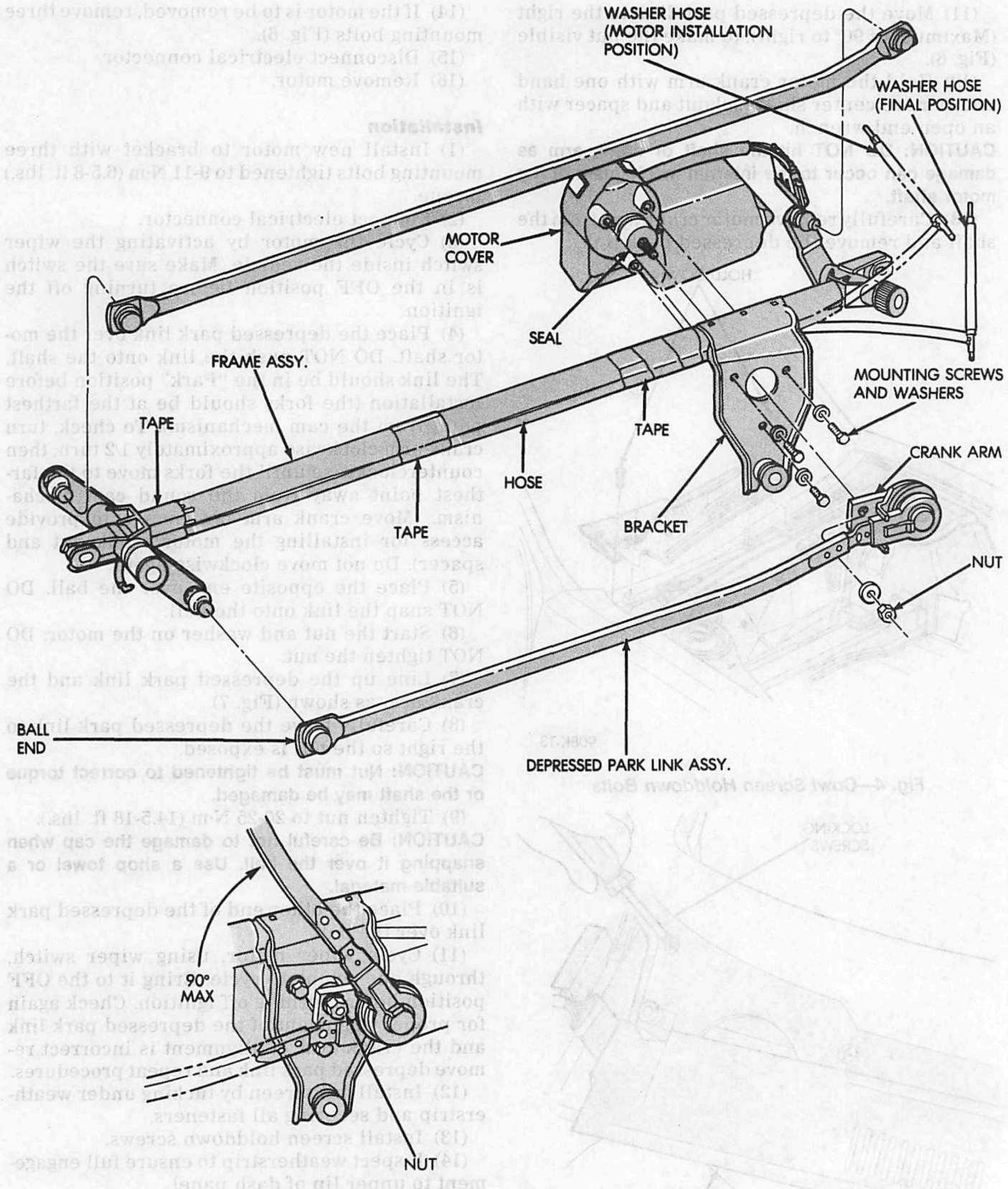


Fig. 6—Windshield Wiper Frame Assembly

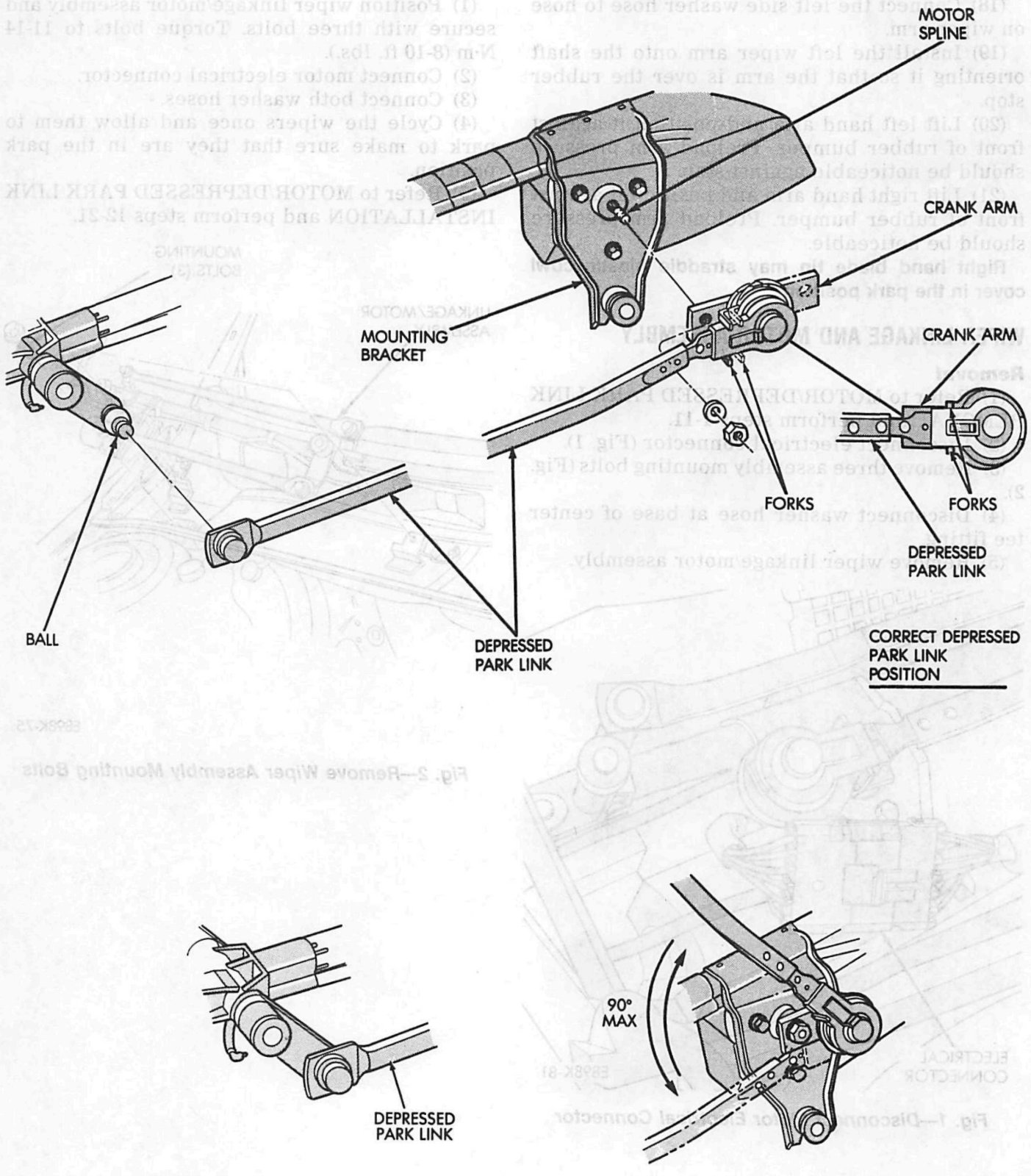


Fig. 7—Depressed Park Installation

(17) Press retainer tab to lock arm on shaft.

(18) Connect the left side washer hose to hose on wiper arm.

(19) Install the left wiper arm onto the shaft orienting it so that the arm is over the rubber stop.

(20) Lift left hand arm and position it against front of rubber bumper. Preload arm pressure should be noticeable against stop.

(21) Lift right hand arm and position it against front of rubber bumper. Preload arm pressure should be noticeable.

Right hand blade tip may straddle plastic cowl cover in the park position.

WIPER LINKAGE AND MOTOR ASSEMBLY

Removal

(1) Refer to MOTOR/DEPRESSED PARK LINK REMOVAL and perform steps 1-11.

(2) Disconnect electrical connector (Fig. 1).

(3) Remove three assembly mounting bolts (Fig. 2).

(4) Disconnect washer hose at base of center tee fitting.

(5) Remove wiper linkage/motor assembly.

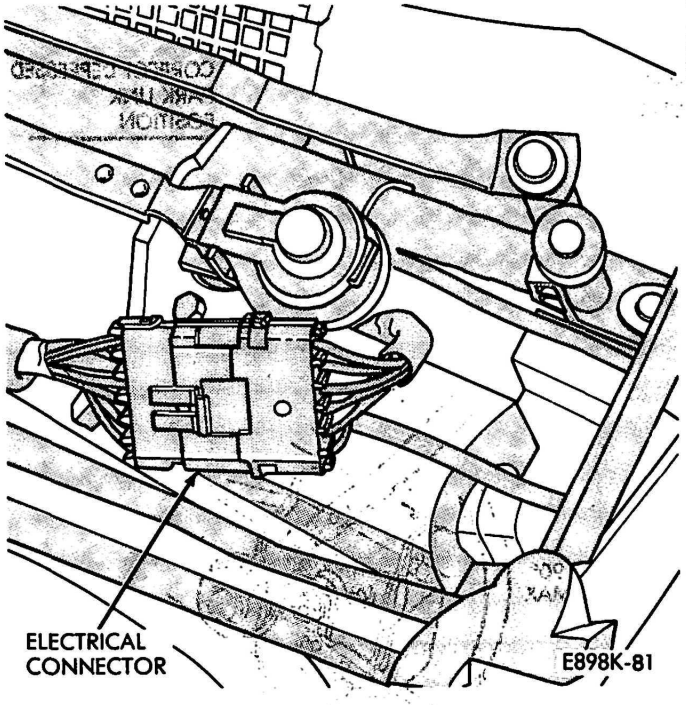


Fig. 1—Disconnect Motor Electrical Connector

Installation

(1) Position wiper linkage/motor assembly and secure with three bolts. Torque bolts to 11-14 N·m (8-10 ft. lbs.).

(2) Connect motor electrical connector.

(3) Connect both washer hoses.

(4) Cycle the wipers once and allow them to park to make sure that they are in the park position.

(5) Refer to MOTOR/DEPRESSED PARK LINK INSTALLATION and perform steps 12-21.

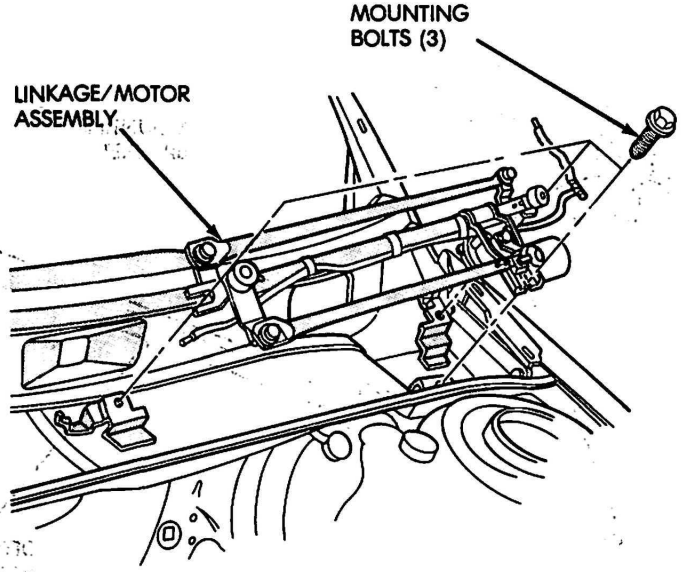


Fig. 2—Remove Wiper Assembly Mounting Bolts

WINDSHIELD WASHER PUMP

Removal

(1) Remove diagnostic connector bracket screws (Fig. 1).
(2) Remove screw (Fig. 2) from windshield washer bottle bracket.
(3) Remove two screws (Fig. 3) from lower bracket.
(4) Unhook reservoir from bracket (Fig. 4).
(5) Lift up washer assembly (Fig. 5).
(6) Disconnect electrical connectors.
(7) Disconnect washer hose and cap pump outlet to prevent spillage of residual fluid in reservoir.
(8) Remove washer assembly from vehicle.

Installation

(1) Connect washer hose to pump.
(2) Connect electrical connectors.
(3) Position washer assembly.
(4) Be sure reservoir is hooked into bracket.
(5) Install two screws in lower bracket.
(6) Install screw in rear bracket.
(7) Position diagnostic connector bracket and secure with screws.

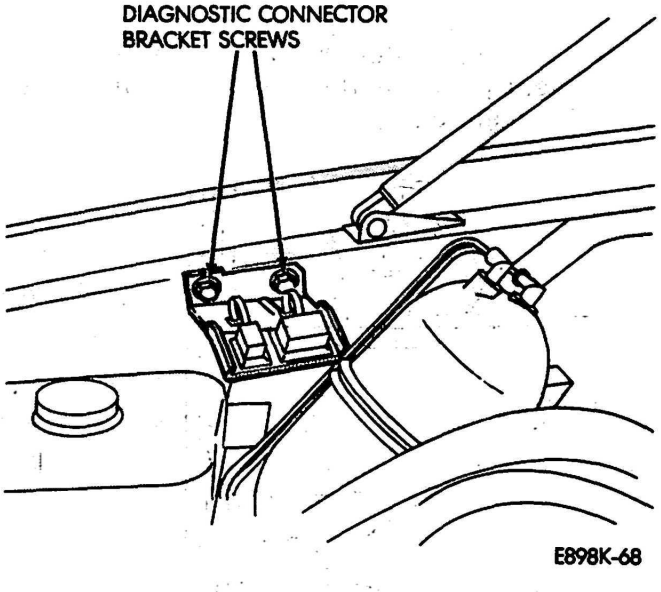


Fig. 1—Remove Diagnostic Connector Bracket

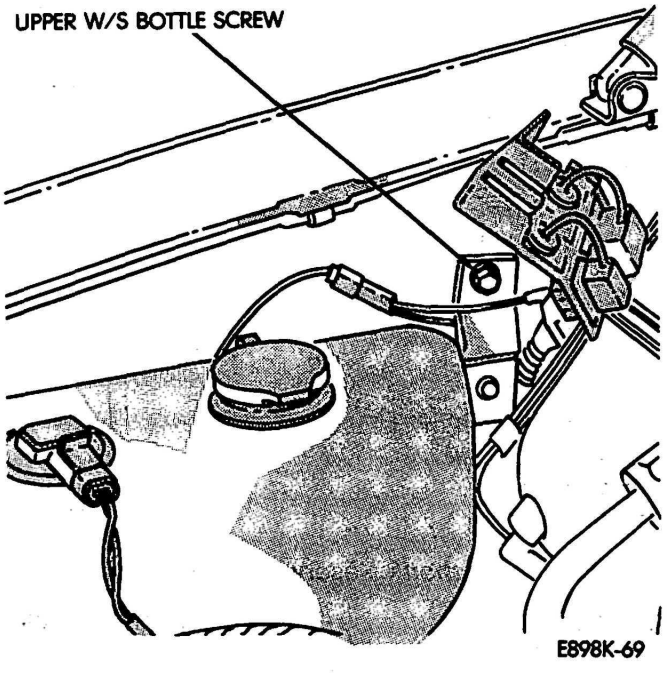


Fig. 2—Remove Upper W/S Washer Bottle Screw

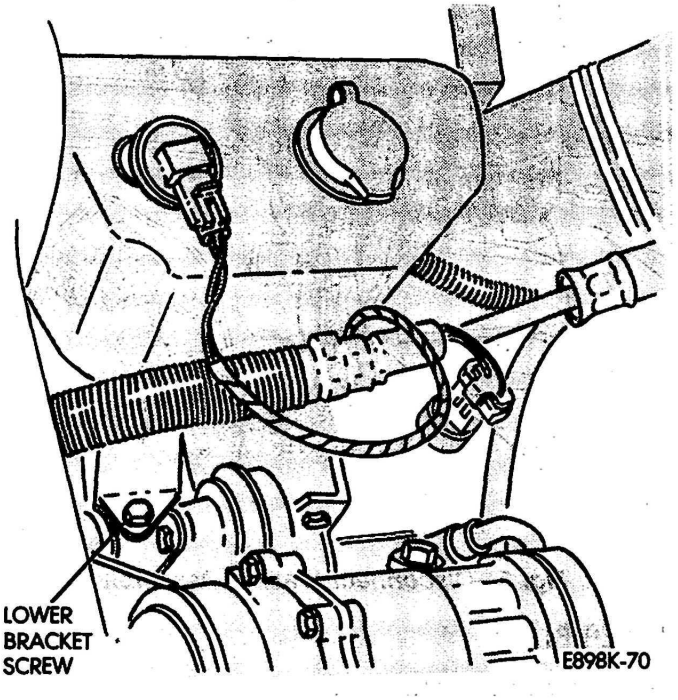


Fig. 3—Remove Lower W/S Washer Bottle Screws

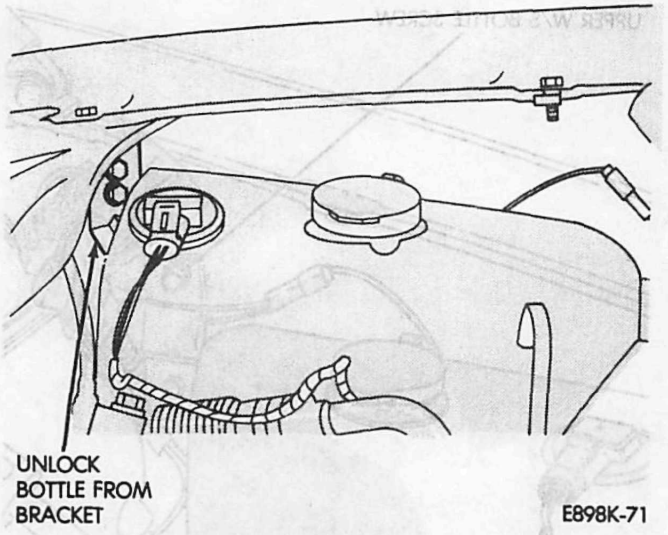


Fig. 4—Unhook Reservoir From Bracket

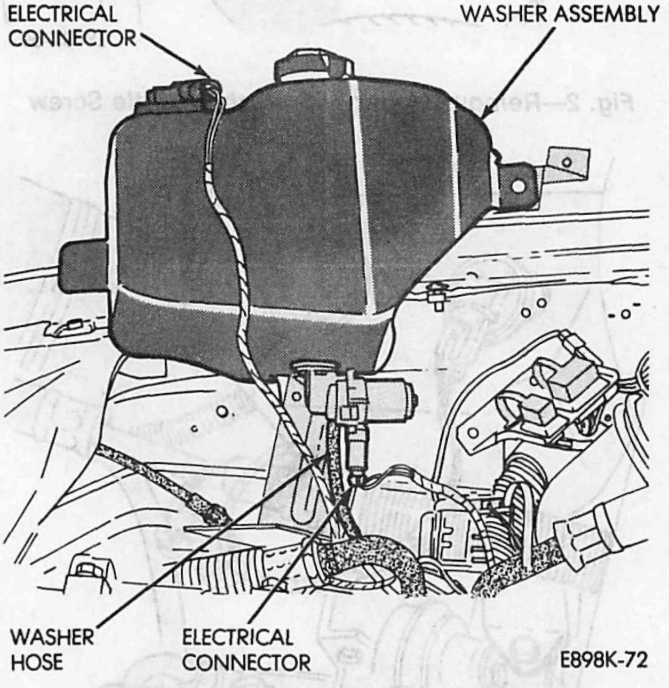


Fig. 5—Disconnect Washer Assembly

WIPER BLADE

Removal and Installation

(1) Depress coil spring in wiper blade (Fig. 1) with tool and remove blade from arm.

(2) To install a blade, snap blade onto arm.

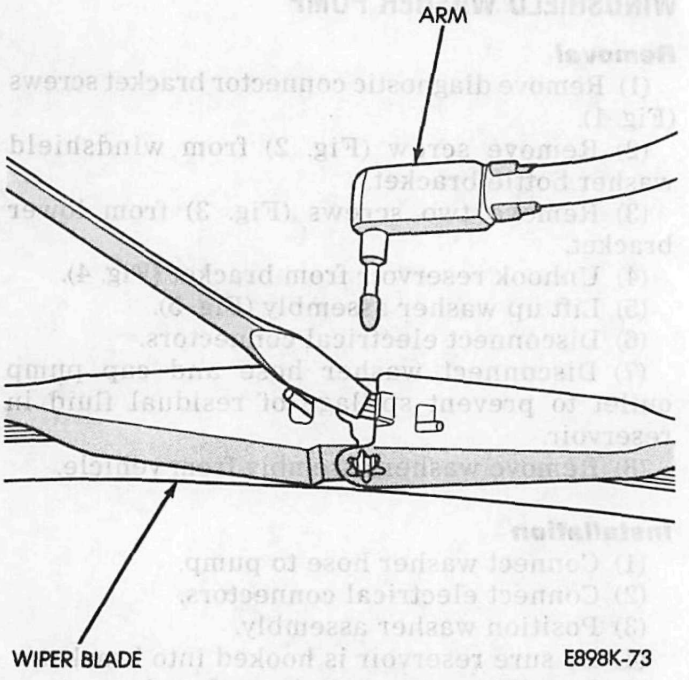


Fig. 1—Wiper Blade Removal

INTERMITTENT WIPER MODULE

Removal

(1) Disconnect battery negative cable.

(2) Reach up under the passenger side of the instrument panel by the courtesy lamp and unplug the module (Fig. 2).

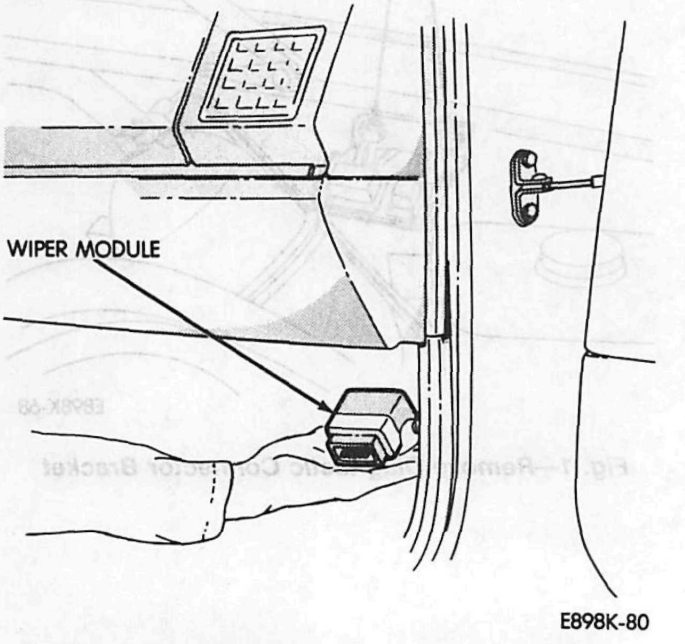


Fig. 2—Intermittent Wiper Module Location

Installation

(1) To install a wiper module, reach up under instrument panel and plug in module.

(2) Connect battery negative cable.

TURN SIGNAL/WIPER/LIGHTS SWITCH

Removal

(1) Disconnect battery negative cable.
(2) Remove screws and instrument panel lower cover if equipped (Fig. 1).
(3) Remove screws (Fig. 2) and remove support bar.
(4) Pull air duct (Fig. 2) out of the way.

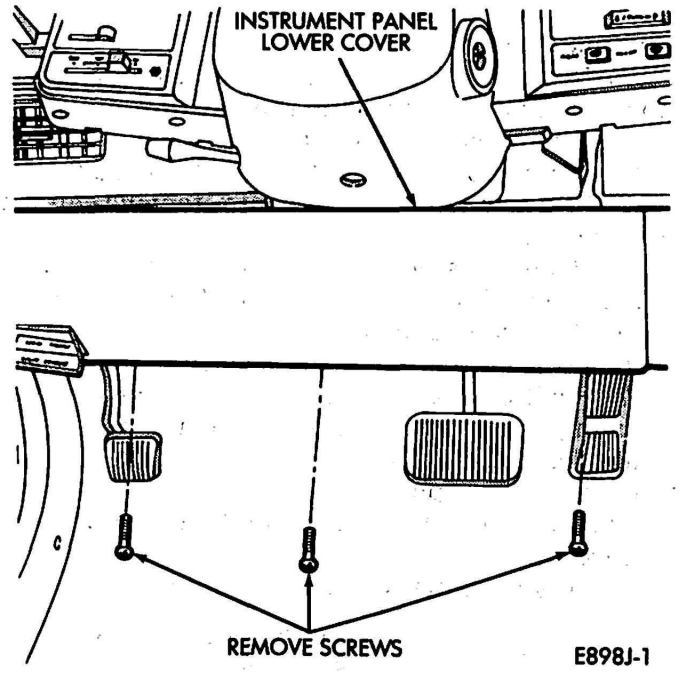


Fig. 1—Remove Instrument Panel Lower Cover

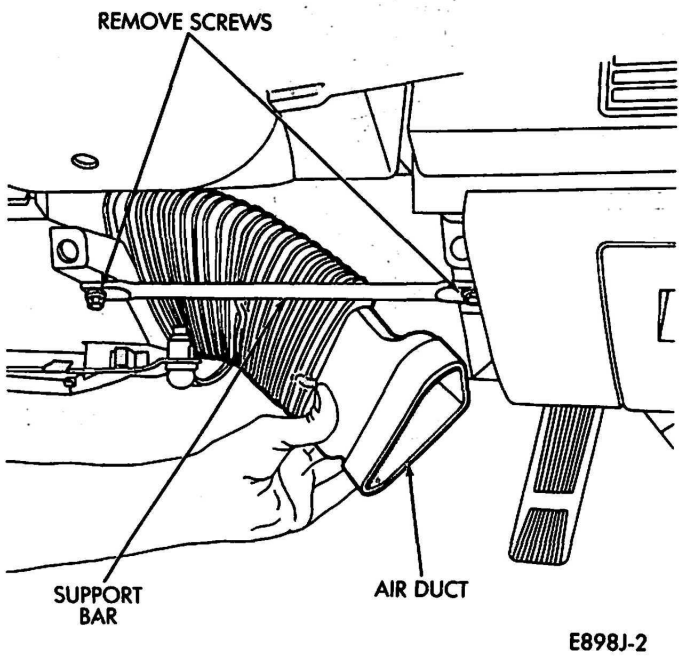


Fig. 2—Remove Support Bar

(5) Remove tie straps (Fig. 3).
(6) Loosen holddown nut in center of steering column connector (Fig. 4).

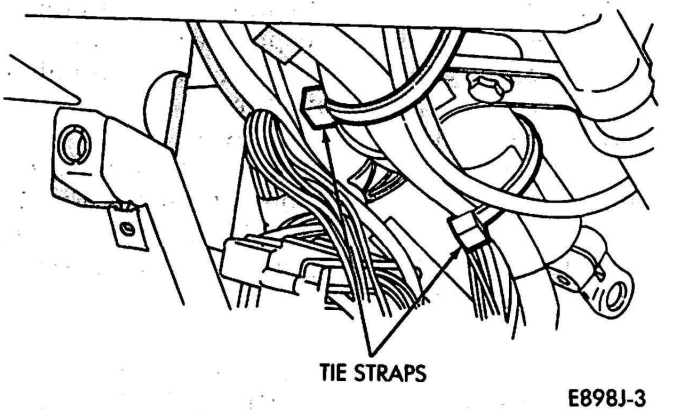


Fig. 3—Remove Tie Straps

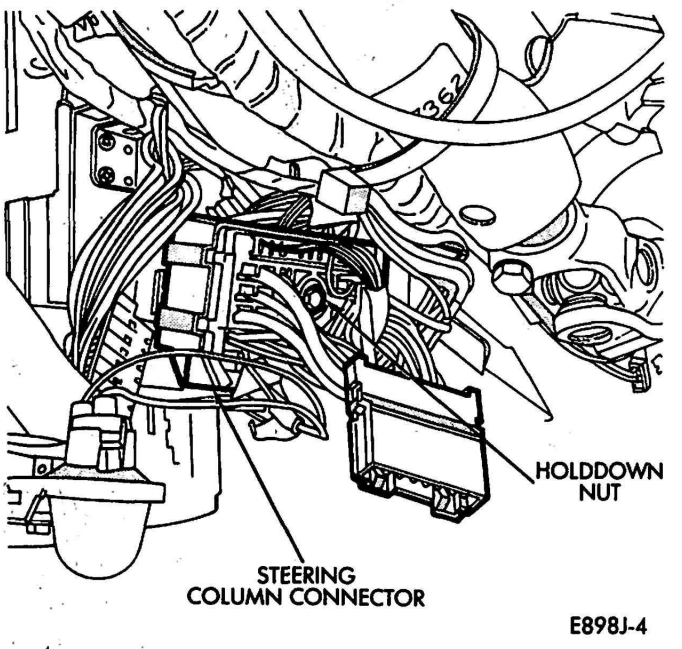


Fig. 4—Loosen Holddown Nut

(7) Separate the steering column connector.

(8) Separate the left hand pod switch connector (Fig. 5) from the steering column connector by placing a flat blade screwdriver between the connectors to disengage locking tab. Push on the wire side of the left hand pod switch connector and slide the connector out of the channels of the steering column connector.

(9) Disconnect connector (Fig. 6).

(10) Remove the bottom two retaining screws from the left hand switch pod assembly (Fig. 7).

(11) Remove screws from the back of the left hand switch pod assembly, and remove the switch pod housing back cover.

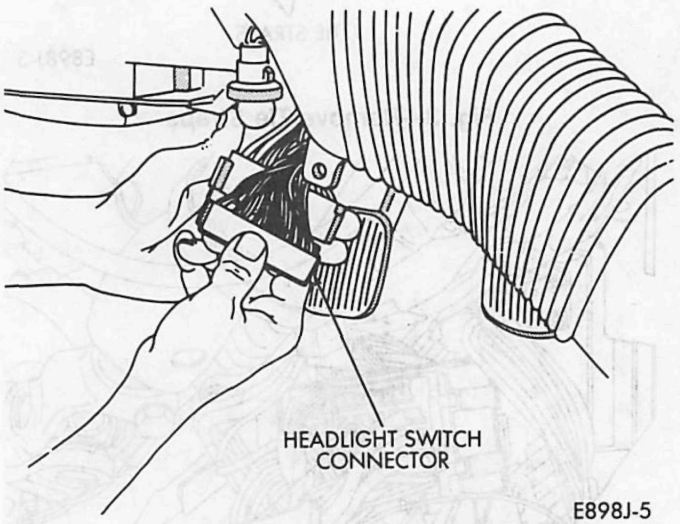


Fig. 5—Left Hand Pod Switch Connector

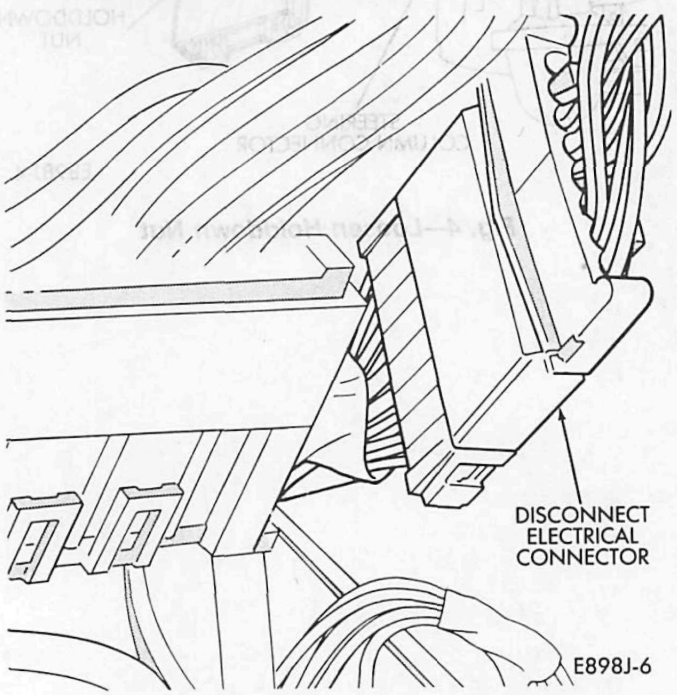


Fig. 6—Disconnect Electrical Connector

There are small retaining clips on the left hand switch pod that may fall off when the switch is removed.

(12) Carefully pull the switch pod far enough from the housing to expose the two screws (Fig. 8).

(13) Remove screws (Fig. 8).

(14) Gently pull switch forward and pull harness out through the housing to remove the switch.

Installation

(1) Route left hand switch pod switch connector end of harness through the housing and along underside of steering column.

(2) Connector electrical connector (Fig. 6).

(3) Slide switch connector into steering column connector.

(4) Position steering column connector and tighten holddown nut in center of connector.

(5) Tie strap harness to column.

(6) Position pod back and secure with screws.

(7) Position the left hand pod switch into the housing and secure with screws (Fig. 7).

(8) Connect air duct.

(9) Install support bar.

(10) Position lower instrument panel cover and secure with screws.

(11) Install battery negative cable.

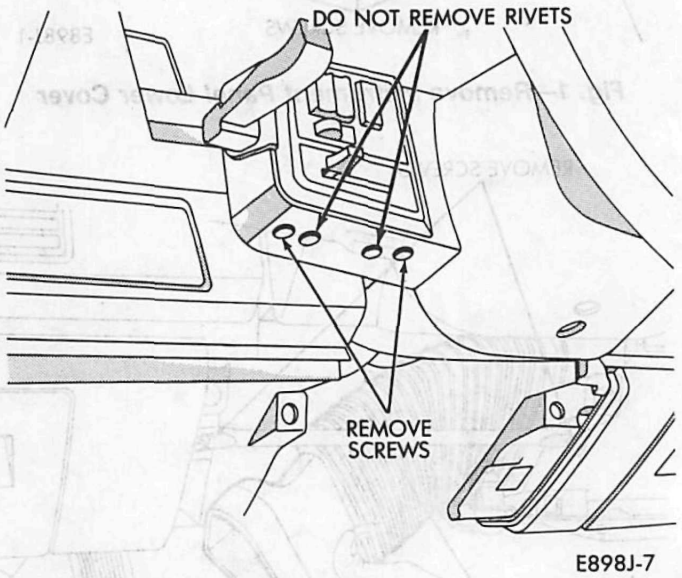


Fig. 7—Remove Screws

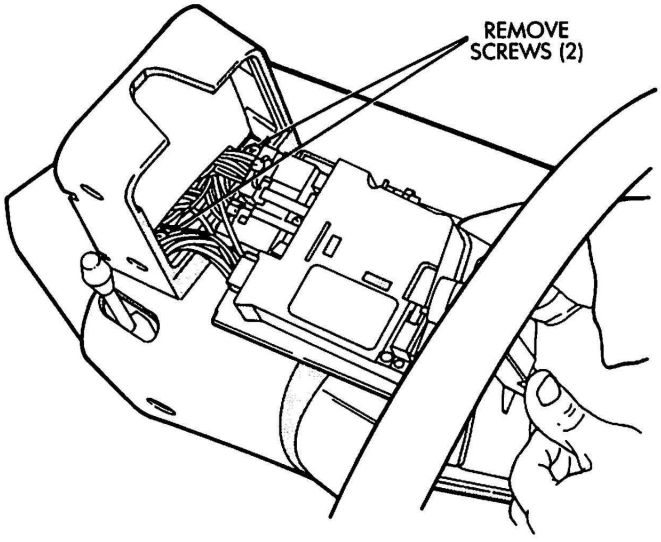


Fig. 8—Remove Two Screws

LAMPS

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EXTERIOR LAMPS

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General Information	1
Diagnostic Procedures	1
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GENERAL INFORMATION

A good electrical ground is mandatory for proper lighting circuit operation. Circuit grounding is provided by the lamp socket when it comes in contact with the metal body, or through a separate ground wire linking the lamp socket to the body on plastic lamp assemblies.

When changing lamp bulbs check the socket for corrosion. If corrosion is present clean it off with a wire brush or replace it and coat the inside of the socket lightly with MOPAR multipurpose grease or petroleum jelly.

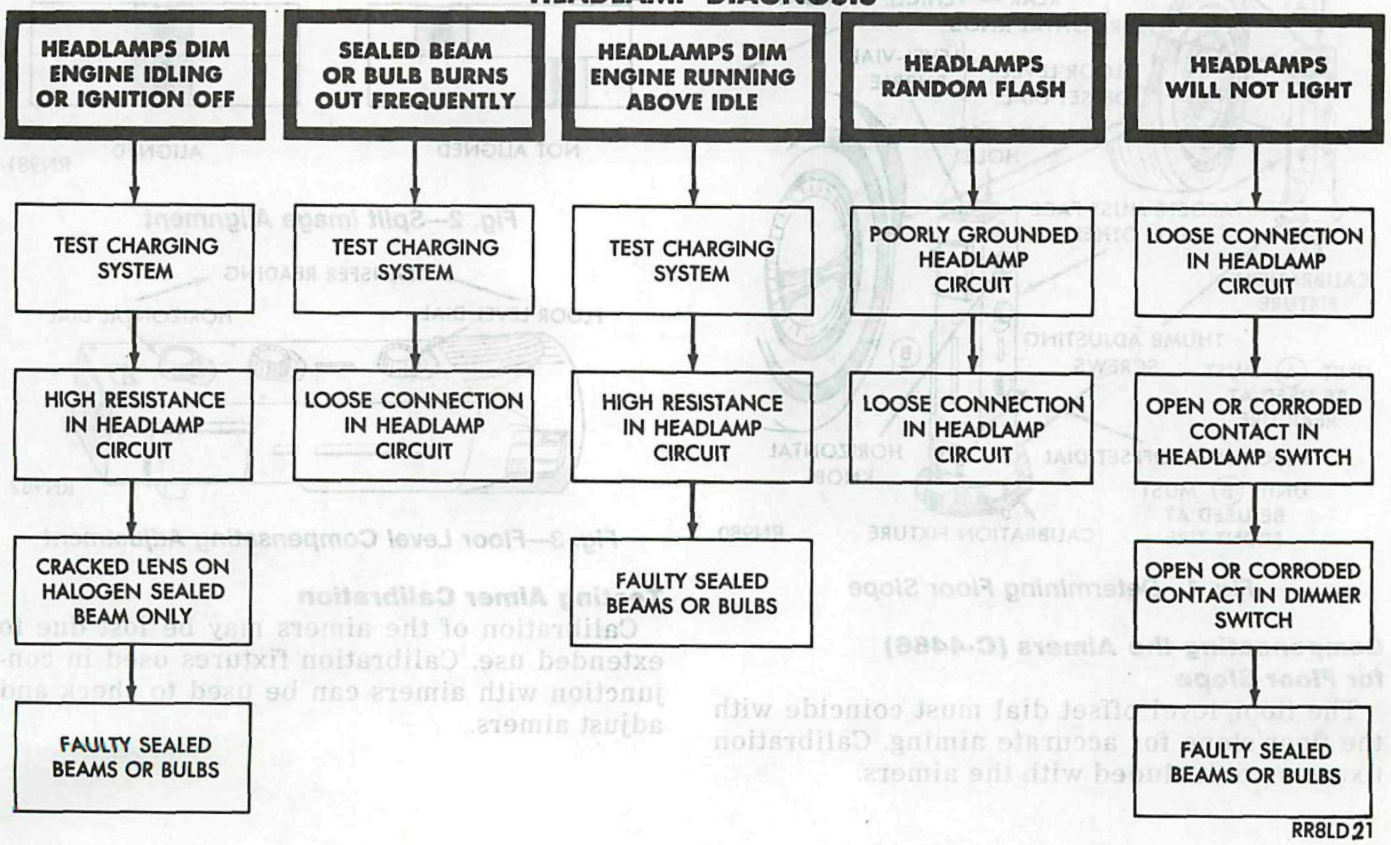
DIAGNOSTIC PROCEDURES

Always begin any electrical system failure diagnosis by testing all of the related fuses and circuit breakers in the fuse block and engine compartment, see Group 8W, Wiring Diagrams for component and splice locations.

Headlamp Dimmer Switch

The headlamp dimmer switch is incorporated in the Turn Indicator Multi-Function switch. Service procedures can be found in Group 8J, Turn Signal and Flashers and Group 8W, Wiring Diagrams.

HEADLAMP DIAGNOSIS



HEADLAMP AIMING PROCEDURES

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Adjustment Method Using Aiming Screen	5
Horizontal Adjustment	4
Mounting Aimers (C-4466)	3
Pre-Aiming Instructions	2
Testing Aimer Calibration	2
Vertical Adjustment	4

Pre-Aiming Instructions

(1) Test dimmer switch operation.

(2) Observe operation of high beam indicator light mounted in instrument cluster.

(3) Inspect for badly rusted or faulty headlamp assemblies. These conditions must be corrected before a satisfactory adjustment can be made.

(4) Place vehicle on a level floor.

(5) Jounce front suspension through three (3) oscillations by applying body weight to hood or bumper.

(6) Inspect tire inflation.

(7) Rock vehicle sideways to allow vehicle to assume its normal position.

(8) If gasoline tank is not full, place a weight in trunk of vehicle to simulate weight of a full tank (6-1/2 pounds per gallon).

(9) Thoroughly clean headlight lenses.

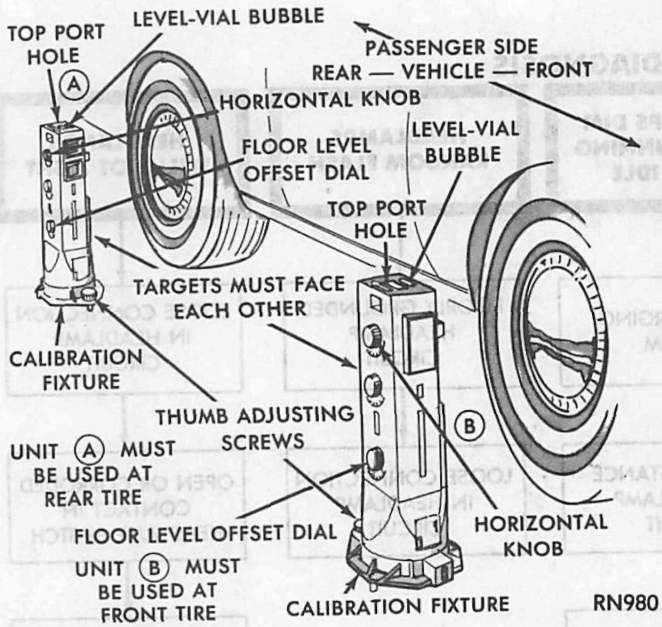


Fig. 1—Determining Floor Slope

Compensating the Aimers (C-4466) for Floor Slope

The floor level offset dial must coincide with the floor slope for accurate aiming. Calibration fixtures are included with the aimers.

(1) Attach one calibration fixture to each aimer. Fixtures will easily snap into position on aimer when properly positioned (Fig. 1).

(2) Place aimers at centerline of each wheel on one side of vehicle (Fig. 1). Unit A must be placed at rear wheel with target facing forward. Unit B must be placed at front wheel with target facing rearward.

(3) Adjust thumb adjusting screw on each calibration fixture by turning either clockwise or counterclockwise until level vial bubble registers in a centered, level position (Fig. 1).

(4) Look into top port hole of Unit A. Turn horizontal knob until split image is aligned (Fig. 2 and 3).

(5) Transfer plus or minus reading indicated on horizontal dial to floor level offset dial on each aimer. Press floor level dial inward to set reading (Fig. 3).

(6) Remove calibration fixtures from both units.

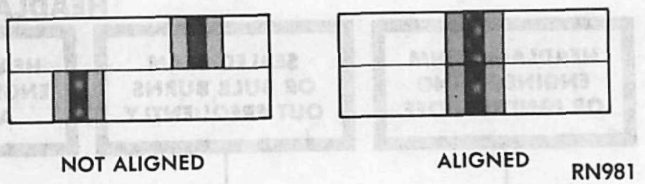


Fig. 2—Split Image Alignment

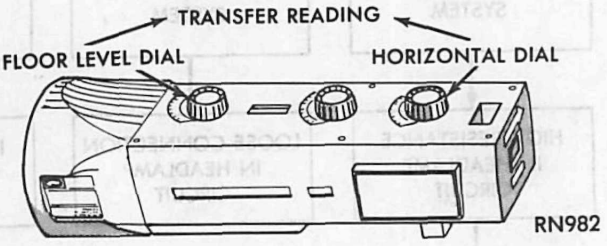


Fig. 3—Floor Level Compensating Adjustment

Testing Aimer Calibration

Calibration of the aimers may be lost due to extended use. Calibration fixtures used in conjunction with aimers can be used to check and adjust aimers.

(1) Turn thumb adjusting screw on each calibration fixture until it is approximately the same distance as the supporting posts (Fig. 4).

(2) Attach calibration fixtures to each unit with level vials on top (Fig. 4).

(3) Locate a true vertical plate glass window or smooth surface and secure aimers three to five feet apart so split image targets can be located in viewing ports (Fig. 5).

(4) Set floor level dial at zero (Fig. 1).

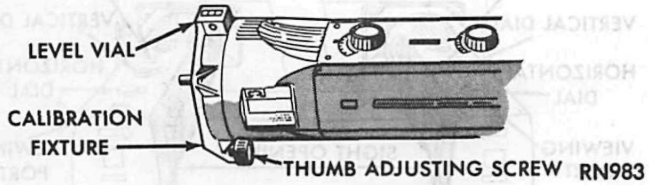


Fig. 4—Calibration Fixture

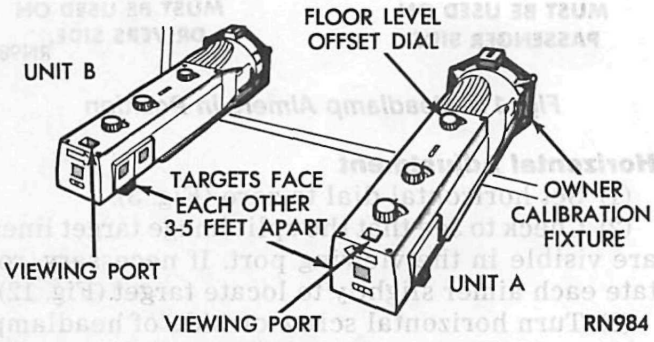


Fig. 5—Checking Aimer Calibration

(5) Rotate adjusting screws on each calibration fixture until level vials on fixtures are centered (Fig. 6).

(6) With both calibration level vials centered turn vertical dial knobs on each aimer until aimer level vials are centered. If aimer vertical dial pointers read between 1/2 up and 1/2 down, aimers are within allowable vertical tolerance. Recalibrate units if beyond these limits (Fig. 6).

(7) Adjust horizontal dial knob on each aimer until split image targets align. If aimer horizontal dial pointers read between 1 left and 1 right, the aimers are within allowable tolerance limits. Recalibrate units if beyond these limits (Fig. 3).

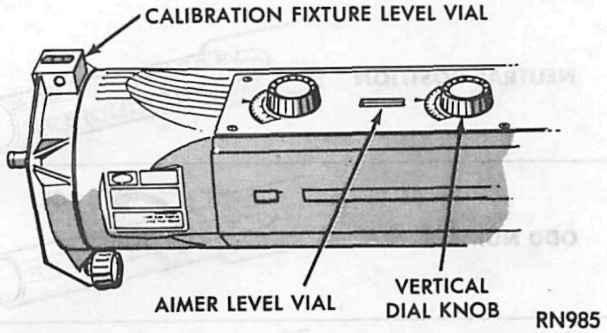


Fig. 6—Checking Vertical Aim Calibration

Mounting Aimers

(1) **Aero** headlamps require a universal adaptor (Fig. 7) to attach the aimer unit to the guide pads on the headlamp lens. Set the adaptor adjustment rods (Fig. 8) as specified on the headlamp lens (V=top pad, H=outboard pad, and the inboard pad=O). To achieve proper adapter spacing from the headlamp lens, add or subtract extension studs on suction cup adaptor (Fig. 9). Assemble the adaptors to the aimer unit (Fig. 10) and proceed to step 2.

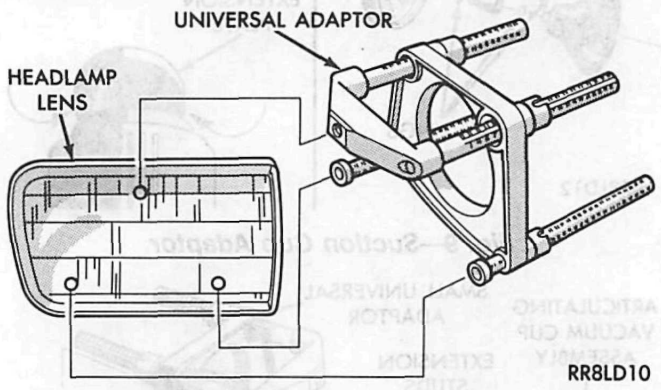


Fig. 7—Aero Headlamp Aimer Adaptor

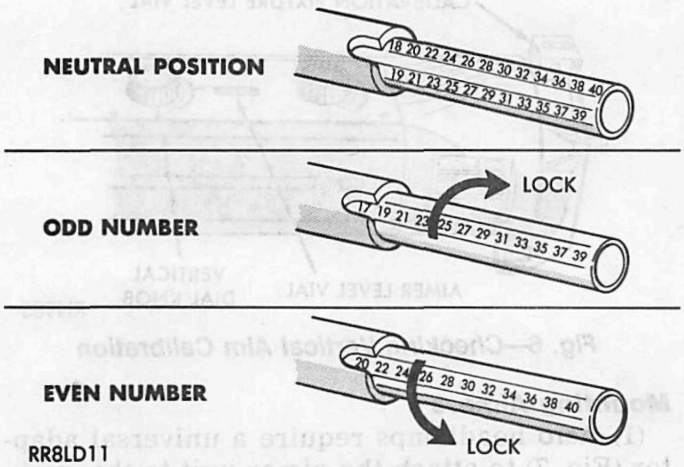


Fig. 8—Adjust Adaptor Rods

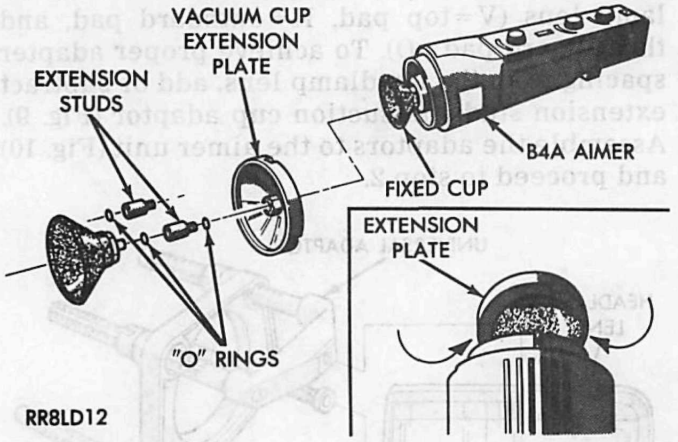


Fig. 9—Suction Cup Adaptor

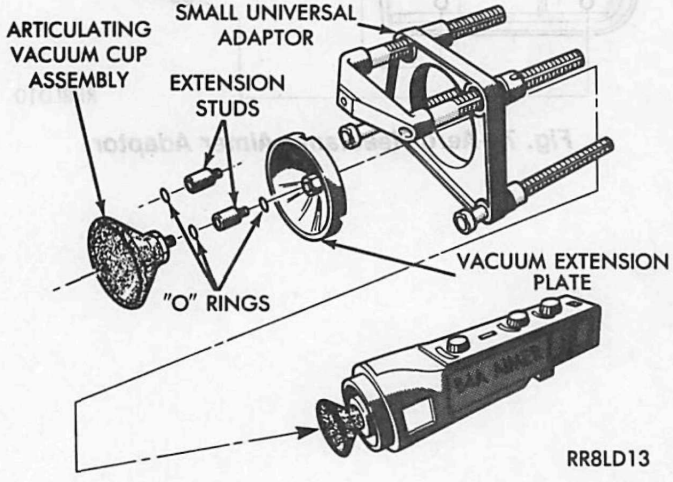


Fig. 10—Assembling Adaptors to Aimer Unit

(2) Position aimers on headlamp pads and push the piston handle forward, engaging rubber suction cup. Immediately pull back piston handle until it locks in place (Fig. 11).

Steel inserts are moulded into position on all adaptors to insure accuracy. These inserts must be in contact with the three guide points on the lamps when the aimers are properly positioned.

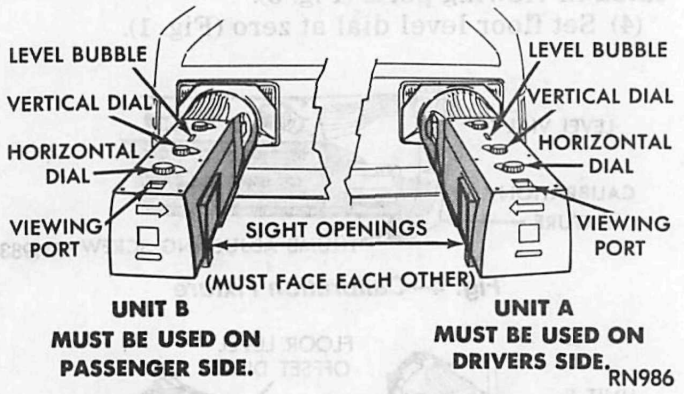


Fig. 11—Headlamp Aimers in Position

Horizontal Adjustment

(1) Set horizontal dial to zero (Fig. 3).

(2) Check to see that the split image target lines are visible in the viewing port. If necessary, rotate each aimer slightly to locate target (Fig. 12).

(3) Turn horizontal screw on side of headlamp until split image of target line appears in mirrors as one solid line (Fig. 12). To remove "backlash," make final adjustment by turning adjusting screw in a clockwise direction.

(4) Repeat the last three steps on opposite headlamp.

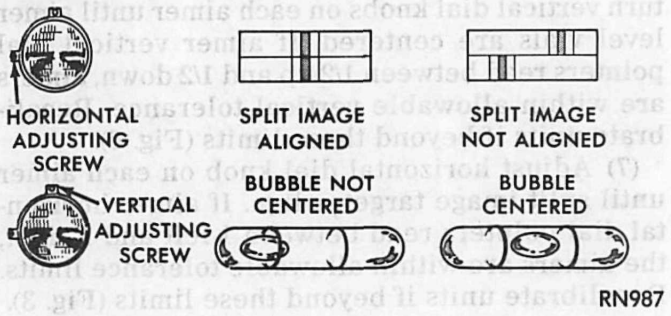


Fig. 12—Split Image and Bubble Alignment and Headlamp Adjusting Points

Vertical Adjustment

(1) The vertical dial should be set at zero. (For passenger vehicles, an "0" setting is generally required. For special setting, consult local state laws.)

(2) Turn vertical adjusting screw (Fig. 6) until the level bubble is centered between the lines (Fig. 8).

(3) Repeat the last two steps on the opposite headlamp.

(4) Verify target alignment on both aimers and adjust horizontal aim if necessary.

(5) Repeat aiming process for a four headlamp system on the second pair of lamps.

(6) Remove aimers by pressing "vacuum release" button located on piston handle.

Adjustment Method Using Aiming Screen

Place vehicle on a known level floor 7.62 meters (25 ft.) from aiming screen or other light colored area. Prepare aiming screen as follows:

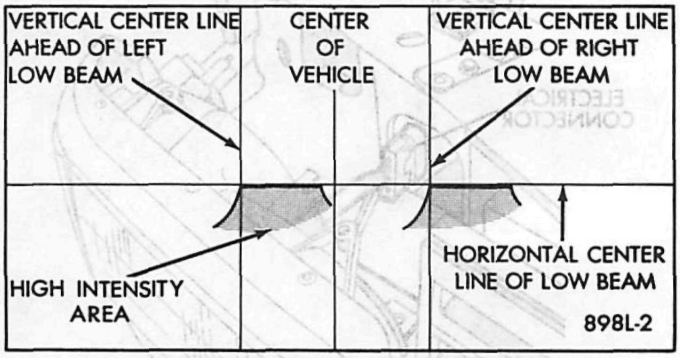


Fig. 13—Low Beam Adjustment Pattern

(1) Position a vertical tape so that it is aligned with the vehicle centerline.

(2) Position a horizontal tape with reference to centerline of headlamp.

(3) Position a vertical tape on the screen with reference to the centerline of each headlamp. A four headlamp system will have four vertical tapes plus the vehicle centerline tape. A two headlamp system will have two vertical tapes plus the vehicle centerline tape.

(4) Open headlamp doors, if so equipped. Adjust top adjusting screw for vertical adjustment, adjust side screw for horizontal adjustment.

(5) A properly aimed low beam will appear on a screen 7.62 meters (25 ft.) in front of the vehicle similar to the pattern shown (Fig. 13).

(6) A properly aimed high beam will project a beam pattern on a screen 7.62 meters (25 ft.) in front of the vehicle similar to the pattern shown (Fig. 14).

(7) A properly aimed fog lamp will project a beam pattern on a screen 7.62 meters (25 ft.) in front of the vehicle like the pattern shown (Fig. 15).

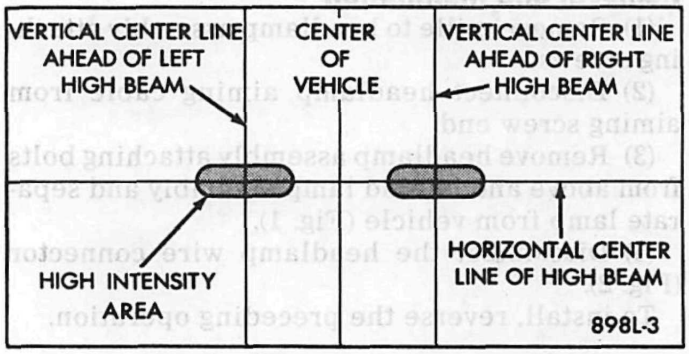


Fig. 14—High Beam Adjustment Pattern

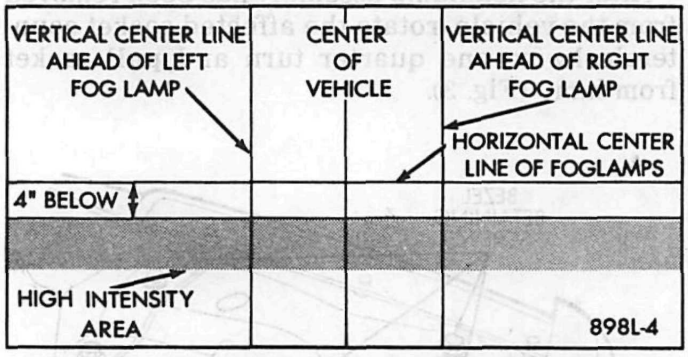


Fig. 15—Fog Lamp Adjustment Pattern

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Park and Turn Signal Lamp	7
Tail, Stop, Turn Signal Lamp	7

AERO HEADLAMP BULB OR LENS REPLACEMENT

Removal and Installation

(1) Remove grille to headlamp assembly attaching screws.

(2) Disconnect headlamp aiming cable from aiming screw end.

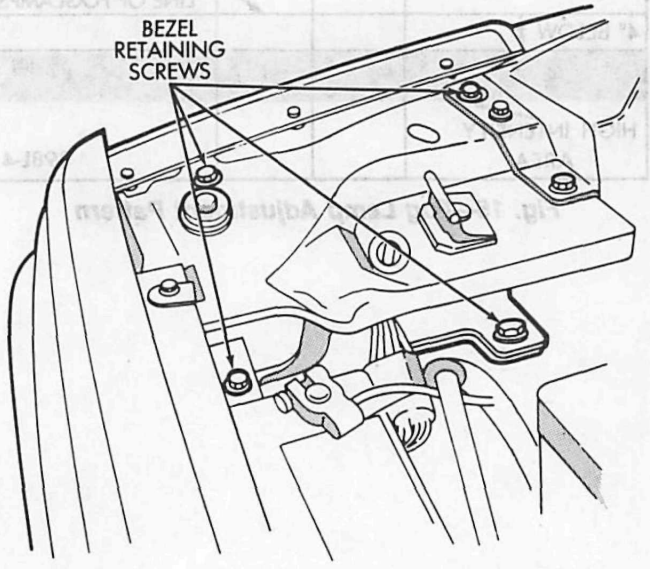
(3) Remove headlamp assembly attaching bolts from above and behind lamp assembly and separate lamp from vehicle (Fig. 1).

(4) Disconnect the headlamp wire connector (Fig. 2).

To install, reverse the preceding operation.

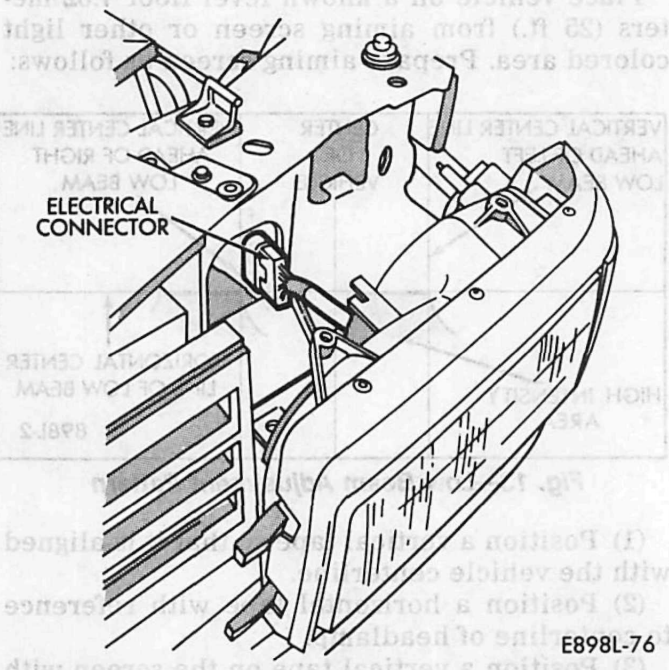
Headlamp Bulb Replacement

After the headlamp assembly has been removed from the vehicle, rotate the affected socket counterclockwise one quarter turn and pull socket from lamp (Fig. 3).



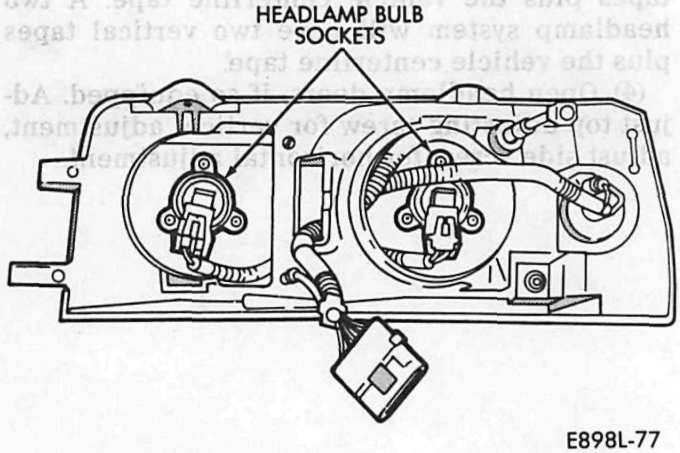
E898L-75

Fig. 1—Remove or Install Attaching Bolts



E898L-76

Fig. 2—Disconnect Headlamp Wire Connector



E898L-77

Fig. 3—Remove or Install Lamp Sockets

PARK AND TURN SIGNAL LAMP

Removal and Installation

The park and turn signal lamp is incorporated into the headlamp assembly.

(1) Remove headlamp assembly from vehicle.

(2) Rotate the park and turn signal lamp socket one quarter turn counterclockwise and pull socket from assembly (Fig. 4).

(3) Remove bulb from socket.

To install, reverse the preceding operation.

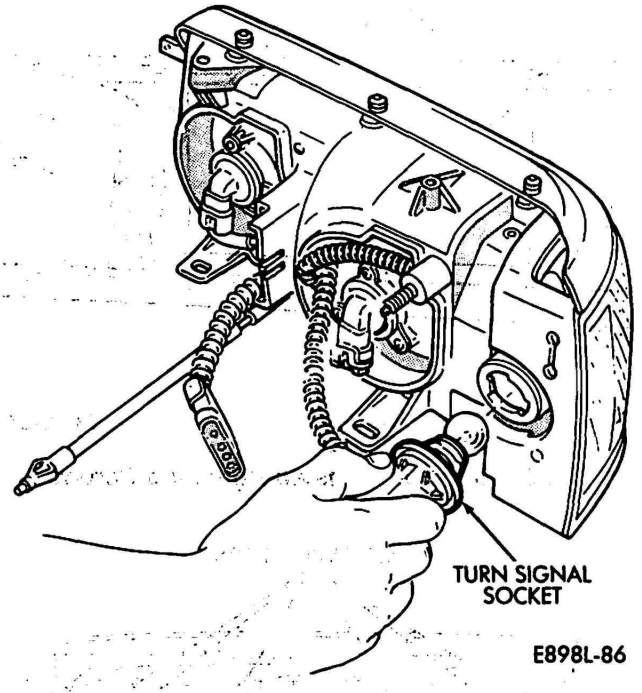


Fig. 4—Remove or Install Park and Turn Signal Lamp Bulb

FRONT SIDE MARKER LAMP

Removal and Installation

The front side marker lamp is incorporated into the headlamp assembly.

(1) Remove headlamp assembly from vehicle.

(2) Remove park and turn signal lamp socket from lamp and position it out of the way.

(3) Remove headlamp mounting bracket attaching screws and separate mount from assembly (Fig. 5).

(4) Rotate side marker lamp socket counterclockwise one quarter turn and pull the socket from the lamp (Fig. 6).

(5) Pull bulb from socket.

To install, reverse the preceding operation.

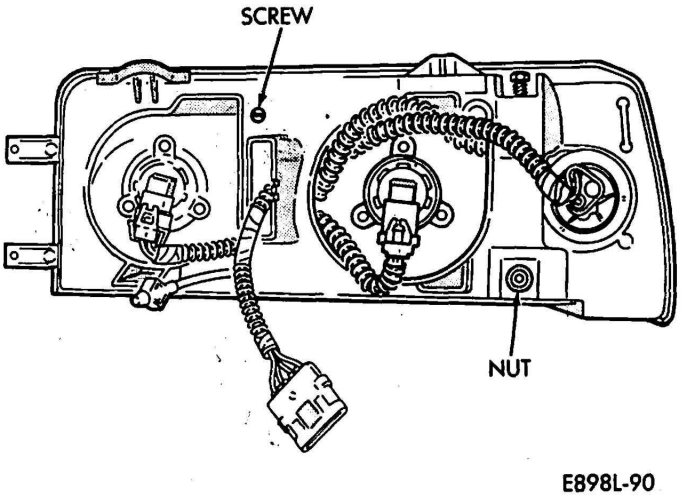


Fig. 5—Separate Mount Bracket From Lamp

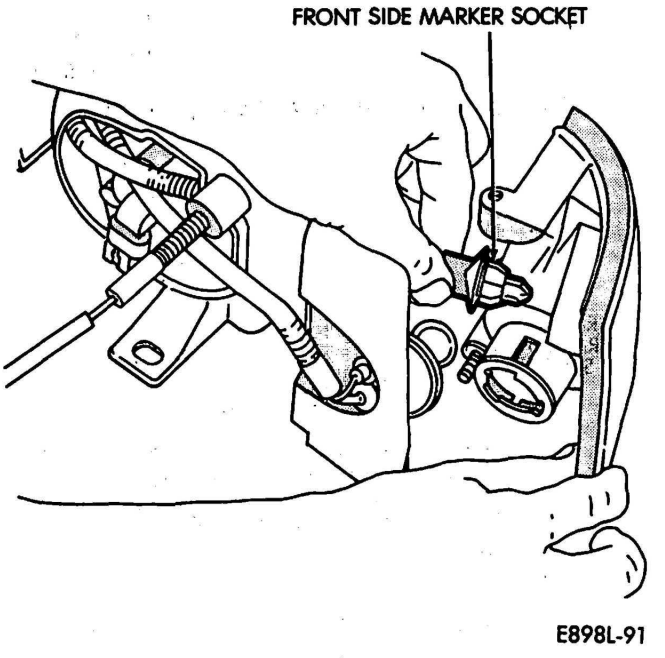


Fig. 6—Remove or Install Front Side Marker Bulb

TAIL, STOP, TURN SIGNAL LAMP

Removal and Installation

(1) Raise deck lid and separate the tail panel trim cover from the tail panel.

(2) Remove tail lamp attaching wing nuts and pull tail lamp assembly from tail panel (Fig. 7).

(3) Rotate tail, stop, and turn signal lamp socket counterclockwise one quarter turn and pull the socket from the lamp assembly (Fig. 8).

(4) Remove bulb from socket.

To install, reverse the preceding operation.

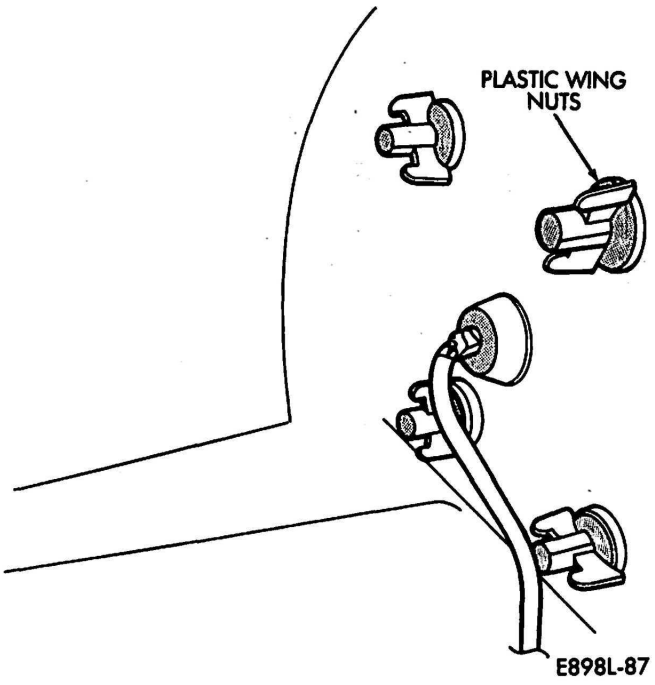


Fig. 7—Remove or Install Tail Lamp Wing Nuts

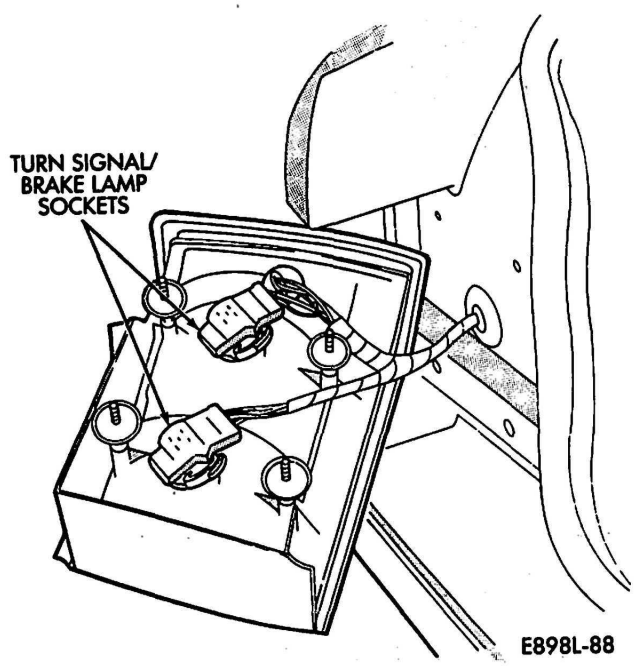


Fig. 8—Tail, Stop, and Turn Signal Lamp

BACK UP LAMP

Removal and Installation

(1) Remove license plate.

(2) Remove attaching screws in license plate opening (Fig. 9).

(3) Raise deck lid and if equipped, separate deck lid liner from back of deck lid.

(4) Remove deck lid lamp attaching wing nuts (Fig. 10) and separate lamp from deck lid.

(5) Rotate back up lamp socket counterclockwise one quarter turn and pull socket from lamp (Fig. 11).

(6) Remove bulb from socket.

To install, reverse the preceding operation.

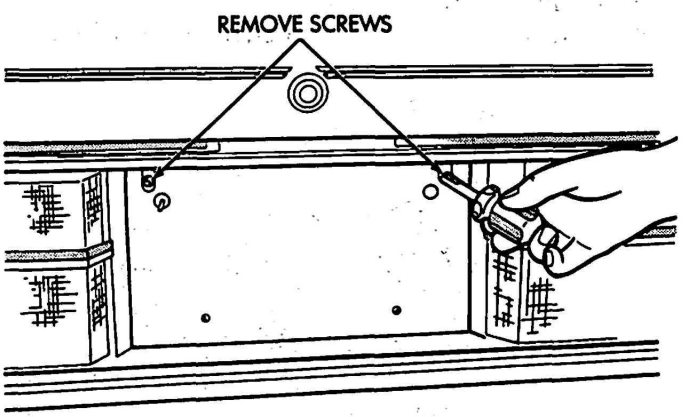


Fig. 9—Remove or Install Attaching Screws

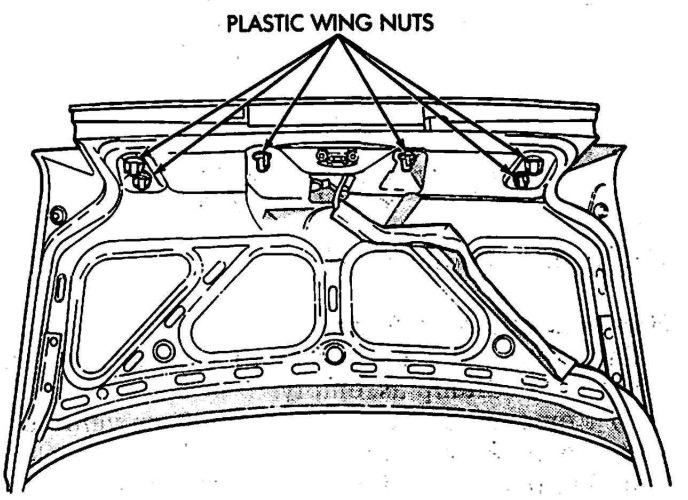
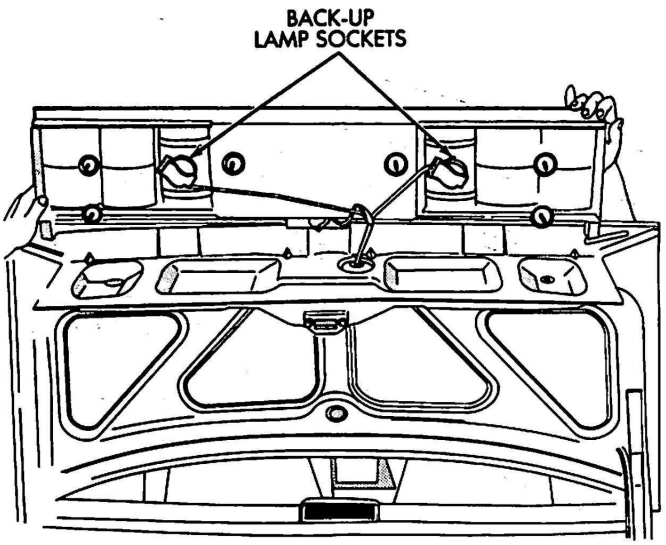


Fig. 10—Remove or Install Deck Lid Lamp Wing Nuts



E898L-82

Fig. 11—Remove or Install Back Up Lamp Sockets

LICENSE PLATE LAMP

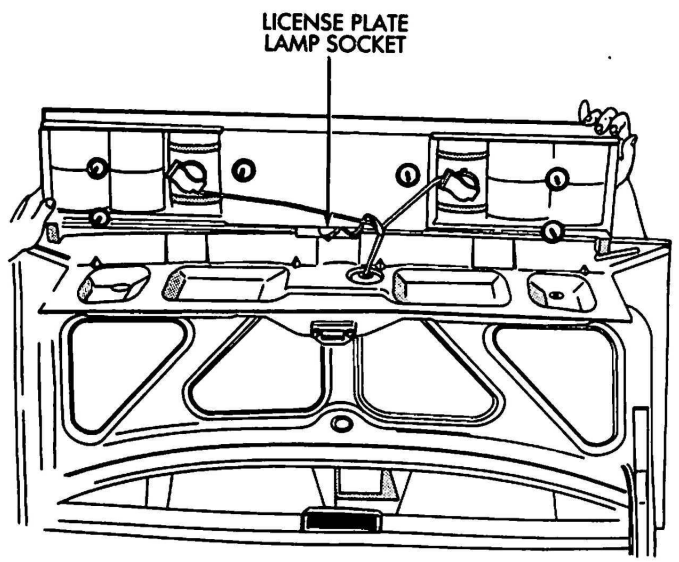
Removal and Installation

(1) Remove deck lid lamp, see back-up lamp procedures.

(2) Rotate license plate lamp socket counterclockwise one quarter turn and pull socket from lamp (Fig. 12).

(3) Remove bulb from socket.

To install, reverse the preceding operation.



E898L-98

Fig. 12—Remove or Install License Plate Lamp Socket

CENTER HIGH MOUNT STOP LAMP

Without Luggage Rack

Removal and Installation

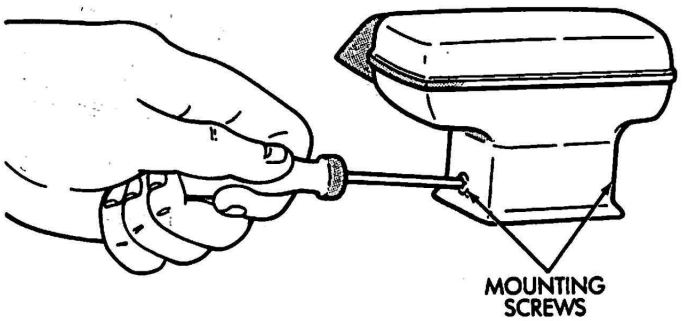
(1) Remove center high mounted stop lamp attaching screws and separate the lamp from the parcel shelf (Fig. 13).

(2) Disconnect wire connector.

(3) Remove lamp top cover attaching screws and separate cover from lamp (Fig. 14).

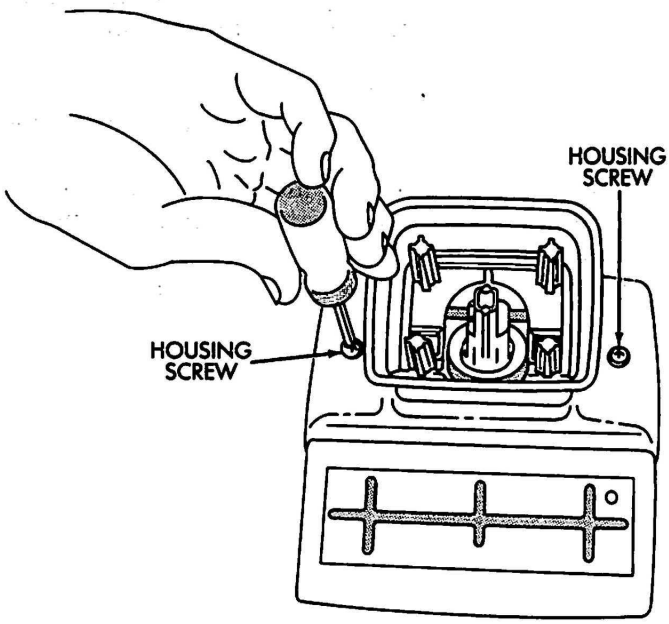
(4) Separate bulb holder from lamp and remove bulb from holder (Fig. 15).

To install, reverse the preceding operation.



E898L-93

Fig. 13—Remove or Install Lamp Assembly



E898L-94

Fig. 14—Remove or Install Lamp Cover

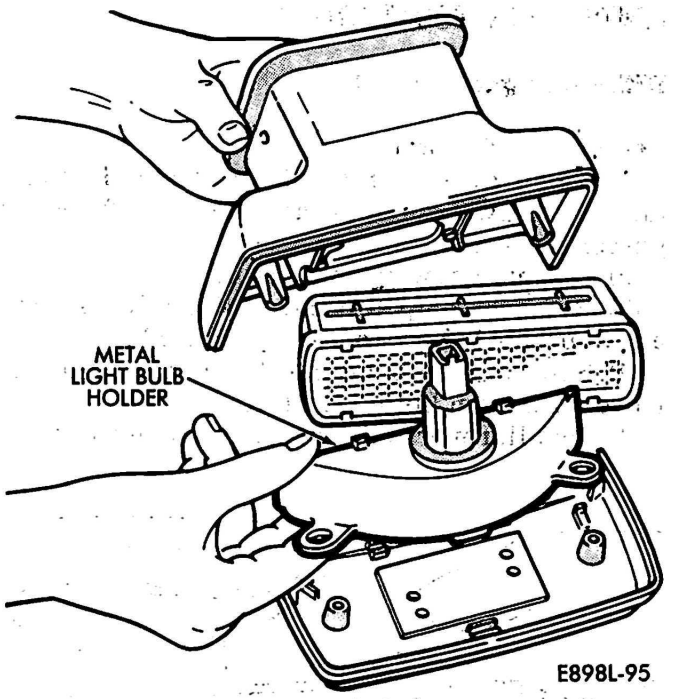


Fig. 15—Remove or Install Bulb Holder

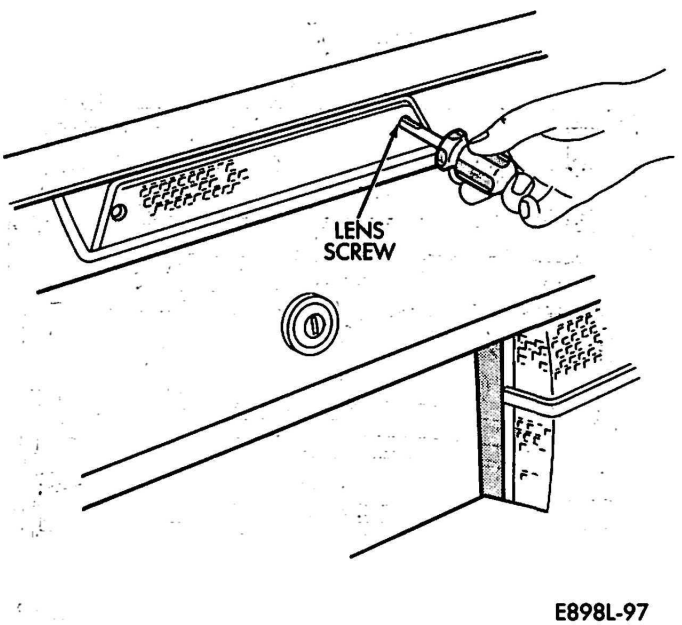


Fig. 16—Remove or Install CHMSL Lens

With Luggage Rack

Bulb Replacement

To replace bulb, remove lens attaching screws (Fig. 16) and separate lens assembly from lamp. Rotate socket counterclockwise one quarter turn and pull socket from lens, pull bulb from socket.

Lamp Removal and Installation

(1) Remove luggage rack rear crossmember, see Group 23, Body.

(2) Remove center high mounted stop lamp attaching screws and separate the lamp from the vehicle.

To install, reverse the preceding operation.

SPECIFICATIONS

INTERIOR LIGHTING

Dimmer Controlled Lamps

A/C Heater Control	#74
Clock	#74
Console Gear Selector	#37
Gear Shift Selector	#73
Headlamp Symbol—Authorized Service Center	
Instrument Cluster Illumination	#194
Radio—Authorized Service Center	
Rear Defogger—Authorized Service Center	

Indicator Lamps

Airbag Indicator	#194
Brake Indicator	#194
Check Engine Indicator	#73
Fog Lamp Indicator	#73
High Beam Indicator	#194
Oil Pressure Indicator	#194
Seat Belt Indicator	#194
Temp Indicator	#194
Trans Warning Indicator	#73
Turn Signal Indicator	#74
Voltage Indicator	#194
Speed Control Indicator	#73

Nondimming Lamps

Front Reading	#906
Rear Reading/Courtesy	#562
Trunk	#89
Underhood	#93
Underpanel Courtesy	#89
Visor Vanity	#74

RESTRAINT SYSTEMS

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	Page		Page
SEAT BELT WARNING SYSTEM	1	PASSIVE SEAT BELTS	9

SEAT BELT WARNING SYSTEM

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	Page		Page
Chime Module Replacement	4	Key in Switch	4
General Information	1	Diagnosis	2

GENERAL INFORMATION

Battery voltage is applied at all times to terminal B1 from Fuse 2. With the ignition switch in RUN, battery voltage is applied to terminal D2 from fuse 8. Battery voltage is also applied as required to auxiliary input, terminal D1, from either the light module, vehicle maintenance monitor and/or trip computer; to headlamp on input, terminal A1 from the light module and the passive belt input, terminal C2, from the passive belt control module.

Ground is applied to operate ignition key input, terminal C1, and set belt input, terminal A2.

Operation of the following responses always requires battery voltage at terminal B1 and ground at terminal B2. To sound the:

SEAT BELT warning, you must also have:

- Battery voltage at terminal D2
- Ground at terminal A2

Ground will be present when the seat belt switch is closed (set belt unbuckled).

KEY IN IGNITION warning, you must also have:

- Ground present at terminal C1

Ground is present at terminal C1 when the key switch is closed (key in ignition) and the LH front door jamb switches are closed (door open).

Headlamps-On Warning you must also have:

- Battery voltage is present at terminal A1 of the module.
- Battery voltage is not present at terminal D2 of the module.

Passive Belt Warning you must also have:

- A signal sent to terminal C2
- Battery voltage at terminal D2

Auxiliary Response you must also have:

- A signal at terminal D1
- Battery voltage at terminal D2

The auxiliary input provides a more frequent chime (faster rate) when the trip computer, VMM, turn signal or bulb outage experiences a mode change.

DIAGNOSIS (Fig. 1)

Module Does Not Chime for Mode Change (Auxiliary Response) of Vehicle Maintenance Monitor, Trip Computer, and Turn Signal or Bulb Outage

Chime Module: Ignition Switch in RUN and Turn Signal ON

TEST	OK	NOT OK
Substitute known good chime module	Module chimes under all of the above conditions	Repair open to components if circuits are good, replace components

Module Does Not Sound Chime For Any Of The Warning Conditions

Chime Module: Ignition Switch in RUN

TEST	OK	NOT OK
Connector A - Terminal B2	Zero Ohms	Repair open to ground
Inspect Fuses 2 and 8	Not blown	Replace fuse
Battery side at Fuses 2 and 8	Battery voltage	Repair open in fuse feed circuit
Connector A - Terminal B1	Battery voltage	Repair open in fuse feed circuit
Connector A - Terminal D2	Battery voltage	Repair open in circuit between Connector A and fuse block

Module Does Not Sound Chime For Headlamp Warning When Headlamps are ON

TEST	OK	NOT OK
Connector A - Terminal A1	Battery voltage	Repair open from lamp monitor module

Module Does Not Sound Chime or Light Indicator When Seat Belt is Left Unbuckled

Seat Belt Circuit: Ignition Switch in RUN

TEST	OK	NOT OK
Connector A - Terminal A2 to ground. Seat belt unbuckled	Zero ohms. If zero ohms, replace chime module	Repair open between Connector A and Seat belt Switch connector
Jumper across seat belt switch	Zero ohms. If OK, replace switch	Repair open to ground

Module Does Not Illuminate Cluster Indicator When Seat Belt is Left Unbuckled, Chime Sounds

Cluster Indicator: Ignition Switch in RUN

TEST	OK	NOT OK
Connector A - Terminal C2 Seat belt unbuckled	Battery voltage	Replace chime module
Inspect seat belt indicator bulb	Battery voltage at bulb connector	Replace bulb
Inspect instrument cluster circuit for cracks or poor connection	Not damaged. If OK, repair open ground	Replace printed circuit

Module Does Not Chime For Key In Ignition Warning When LH Front Door Is Opened

Key Warning Circuits: Key In Ignition, LH Front Door Open

TEST	OK	NOT OK
Connector A - Terminal C1 to ground	Zero ohms. If zero ohms, replace chime module	Go to next step
Jumper Connector A - Terminal C1 to ground	Chime sounds. Repair open to ground (includes LH door jamb switch and key-in switch)	Repair open to ground

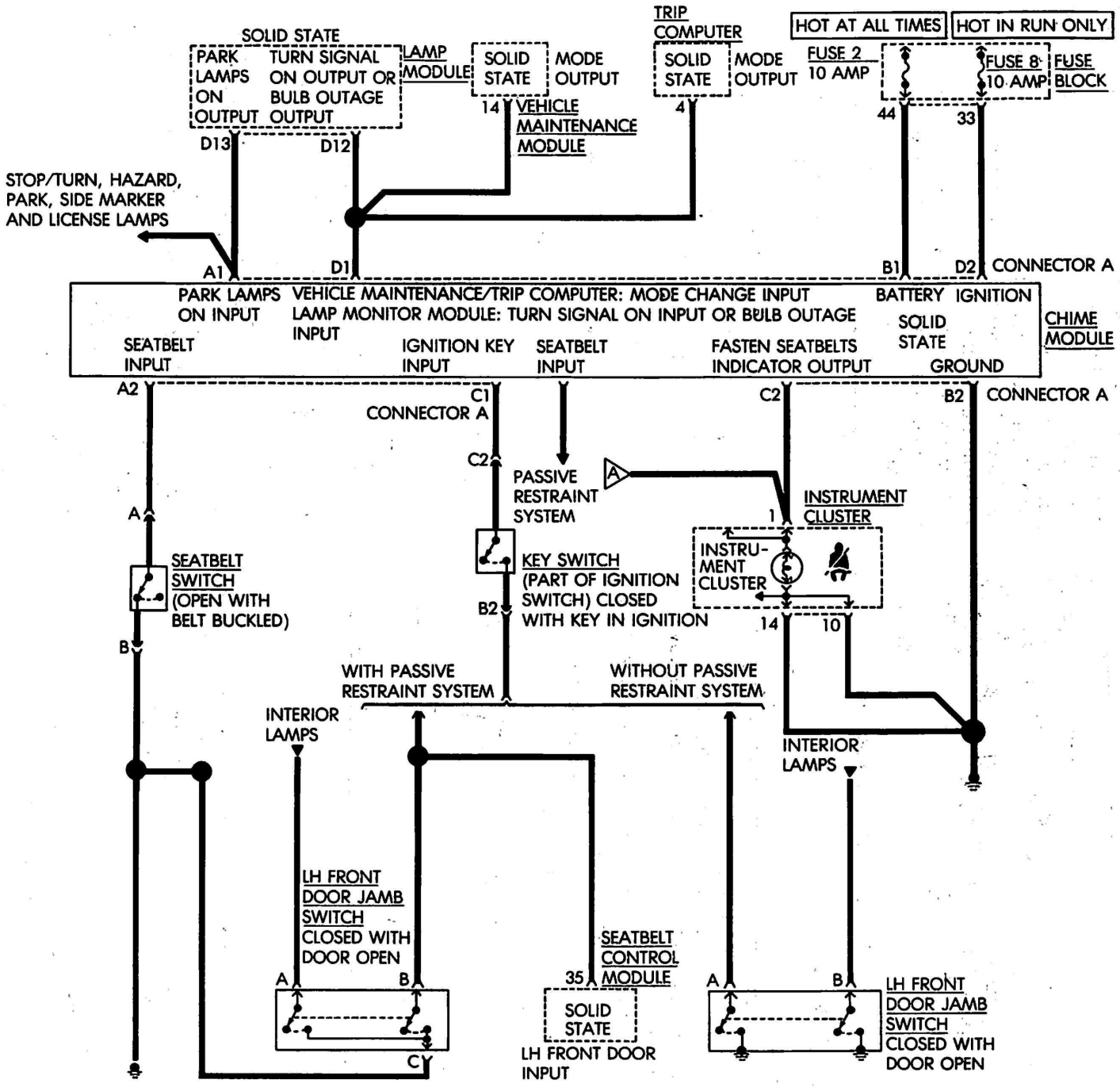


Fig. 1—Chime System Schematic

E898M-4

CHIME MODULE

Removal and Installation

(1) Disconnect battery negative cable.

(2) Reach up under the drivers side of the instrument panel, between the steering column and the kick panel near the floor, and unplug the chime module (Fig. 2).

(1) To install the chime module, reverse the removal procedure procedures.

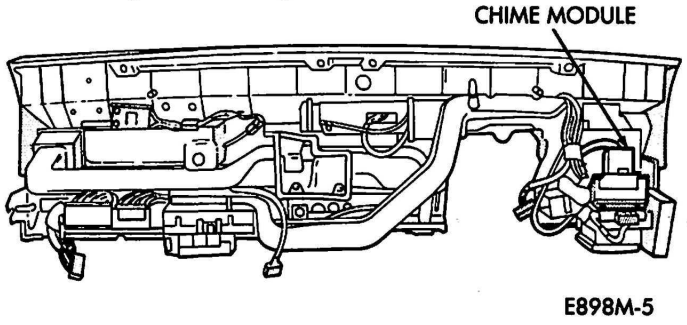


Fig. 2—Chime Module Location

KEY IN SWITCH

Removal

(1) Remove screws and instrument panel lower cover if equipped (Fig. 1).

(2) Unsnap the horn button (Fig. 2).

(3) Disconnect wires (Fig. 2) and remove the horn button.

(4) Note position of the reference mark (Fig. 2) on the end of the steering shaft.

It is not necessary to use a puller to remove the steering wheel from the shaft.

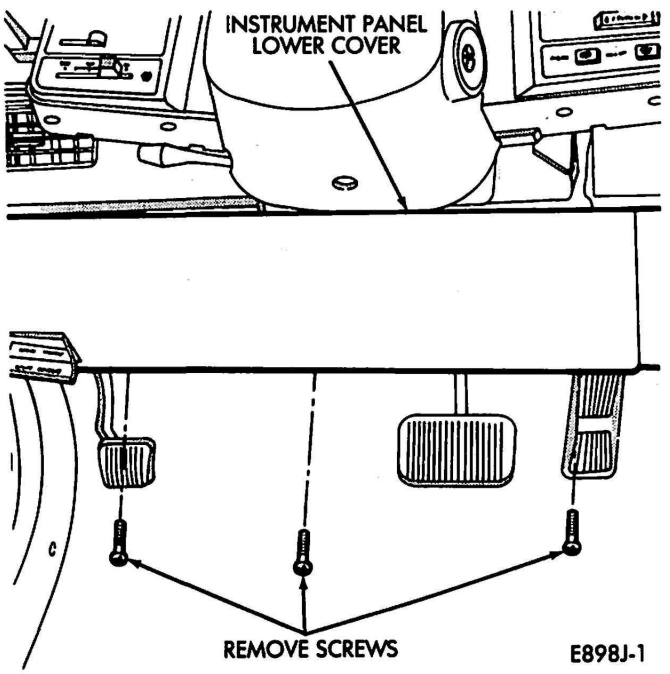


Fig. 1—Remove Instrument Panel Lower Cover

(5) Remove the steering wheel nut (Fig. 2) and slide the steering wheel off the shaft.

(6) Disconnect electrical connector and remove the steering wheel.

(7) Remove turn signal cancel cam (Fig. 3) by unhooking tabs and sliding cancel cam off steering column.

Three small bent paper clips may be used to hold the tabs away from the shaft while sliding the cam off.

(8) If vehicle is equipped with tilt wheel remove tilt wheel control lever.

(9) Remove the bottom two retaining screws from the left hand switch pod assembly (Fig. 4).

(10) Remove screws from the back of the left hand switch pod assembly, and remove the switch pod housing back cover.

There are small retaining clips on the left hand switch pod that may fall off when the switch is removed.

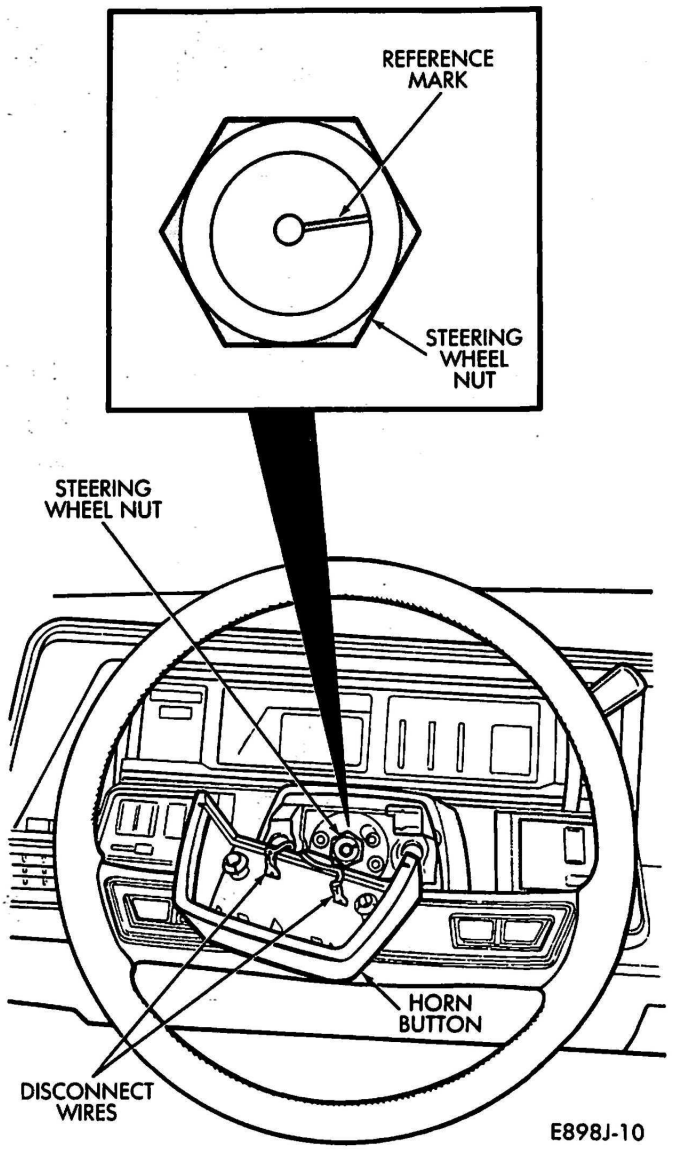


Fig. 2—Remove Horn Button

(11) Remove the bottom two retaining screws from the right hand (Heat/AC) switch pod assembly (Fig. 5).

(12) Remove screws from the back of the right hand switch pod assembly, and remove the switch pod housing back cover.

(13) Carefully pull the switch pod assemblies far enough from the housing to expose the housing mounting screws (Figs. 7, 8).

(14) Remove ignition switch trim ring (Fig. 6) by prying it away from the switch pod housing.

(15) Remove two left hand switch pod housing mounting screws (Fig. 7).

(16) Remove two right hand switch pod housing mounting screws (Fig. 8).

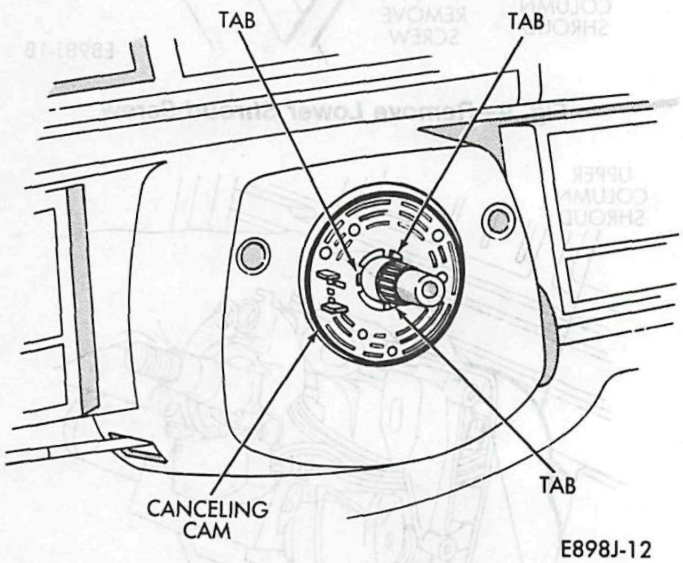


Fig. 3—Remove Turn Signal Cancel Cam

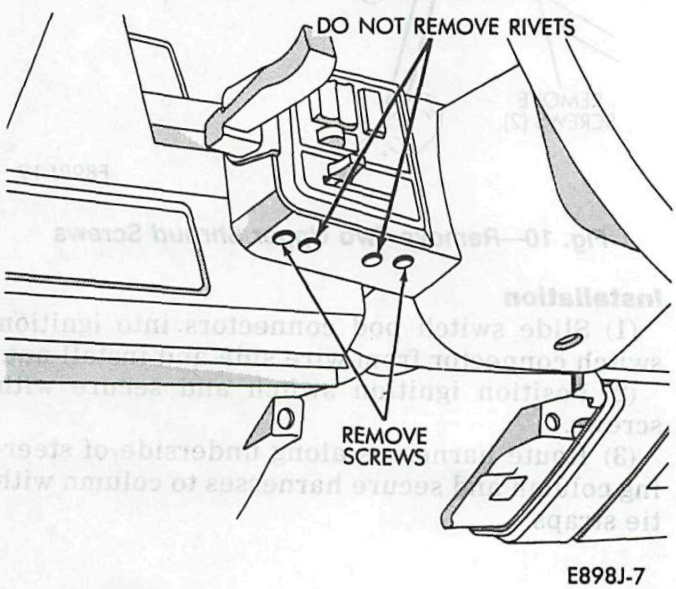


Fig. 4—Remove Screws

(17) Pass both switch pod assemblies through the back openings in the switch pod housing.

(18) Remove screw holding lower column shroud (Fig. 9).

(19) Separate and remove the lower column shroud.

(20) Remove two screws (Fig. 10) and remove upper column shroud.

(21) Remove ignition switch retaining screws (Fig. 11).

(22) Separate ignition switch from lock cylinder housing.

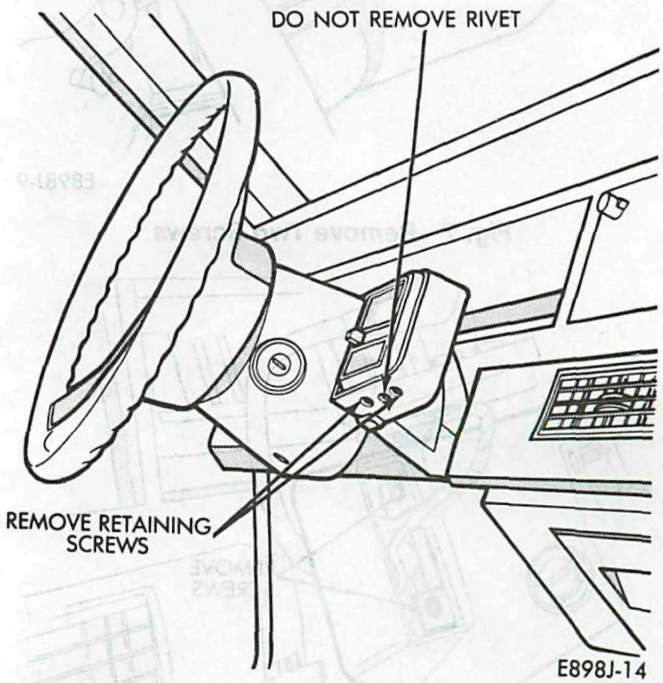


Fig. 5—Remove Right Hand Switch Pod (Heat/AC) Retaining Screws

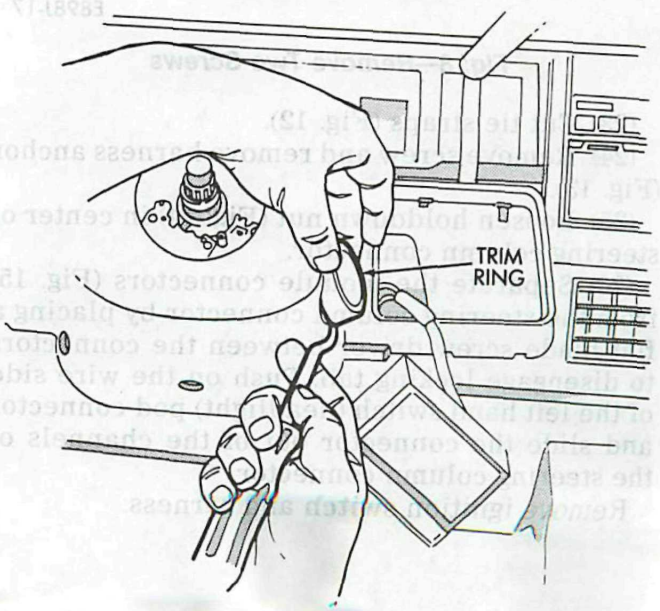


Fig. 6—Remove Ignition Switch Trim Ring

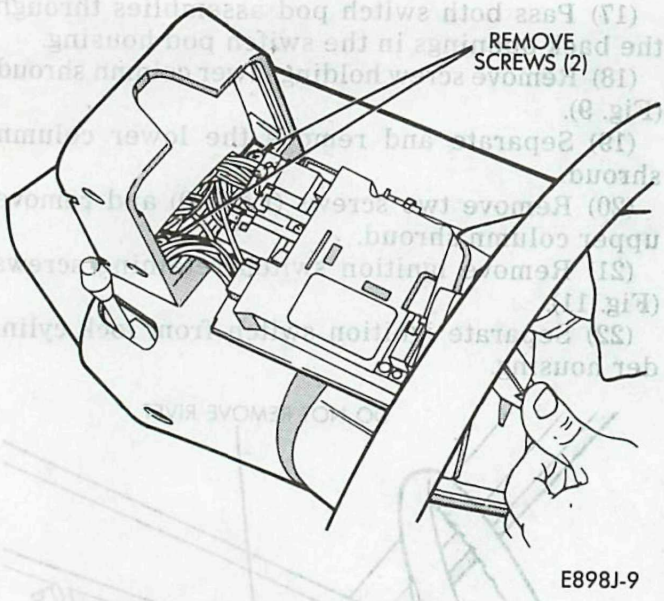


Fig. 7—Remove Two Screws

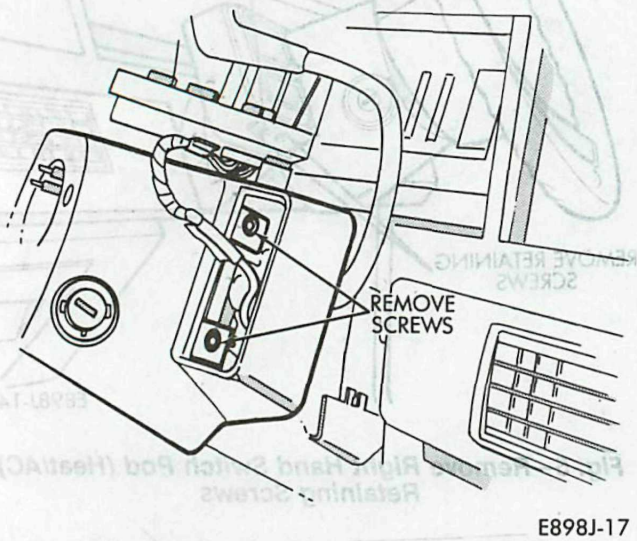


Fig. 8—Remove Two Screws

(23) Cut tie straps (Fig. 12).

(24) Remove screw and remove harness anchor (Fig. 13).

(25) Loosen holddown nut (Fig. 14) in center of steering column connector.

(26) Separate the module connectors (Fig. 15) from the steering column connector by placing a flat blade screw driver between the connectors to disengage locking tab. Push on the wire side of the left hand switch (headlight) pod connector and slide the connector out of the channels of the steering column connector.

Remove ignition switch and harness.

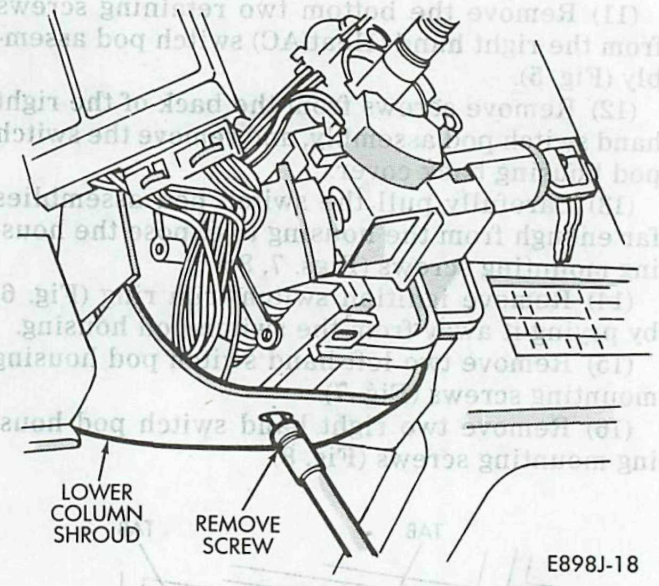


Fig. 9—Remove Lower Shroud Screw

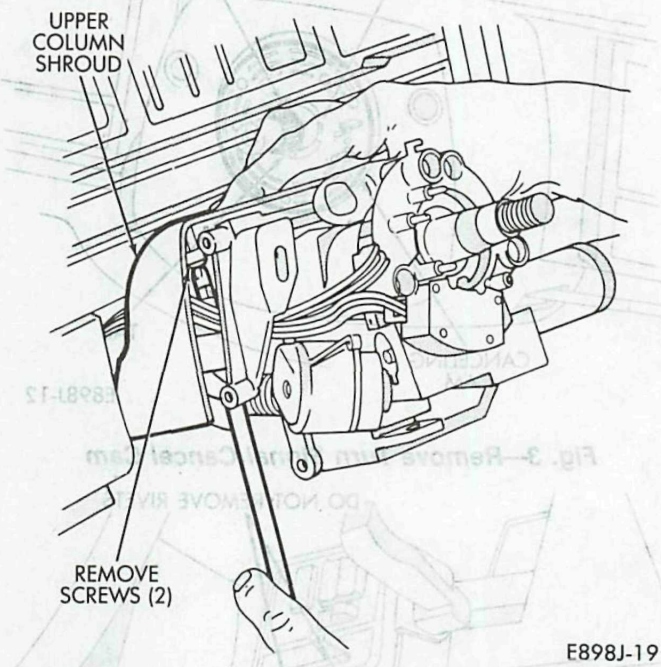


Fig. 10—Remove Two Upper Shroud Screws

Installation

(1) Slide switch pod connectors into ignition switch connector from wire side and install nut.

(2) Position ignition switch and secure with screws.

(3) Route harnesses along underside of steering column and secure harnesses to column with tie straps.

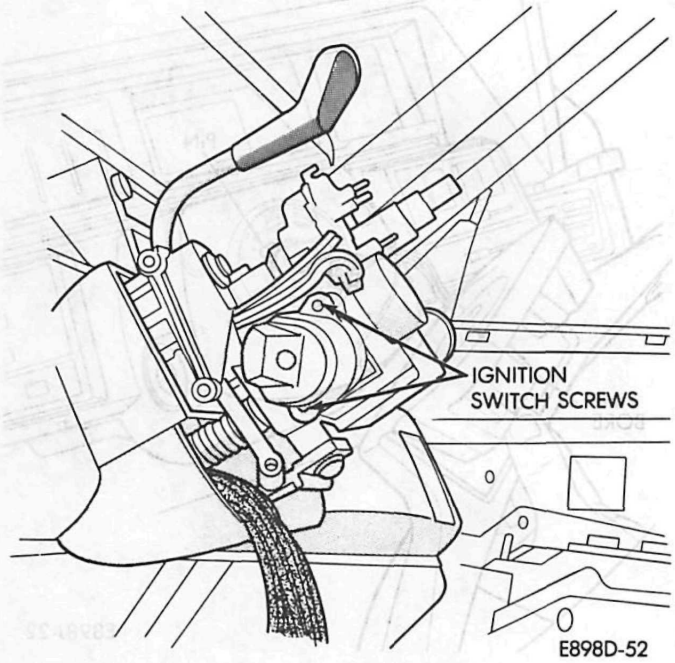


Fig. 11—Remove Ignition Switch Screws

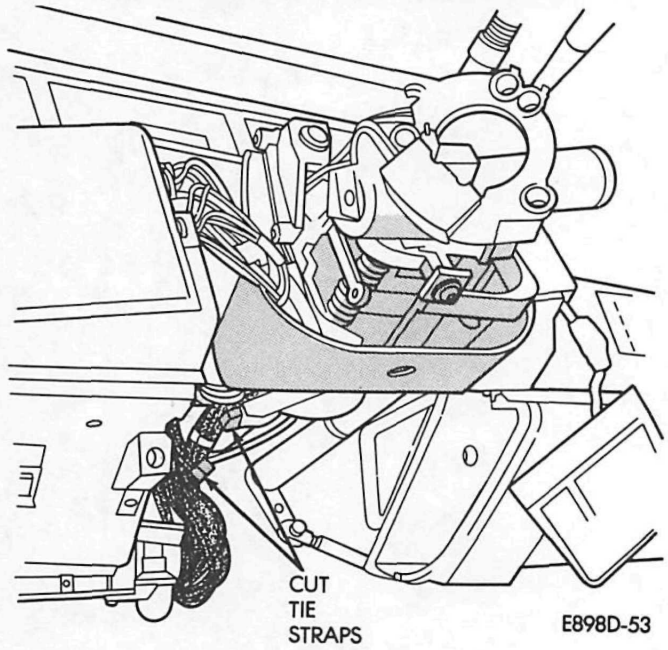


Fig. 12—Cut Tie Straps

(4) Install harness anchor and secure to column with screw.

(5) Reverse the remaining removal procedures to complete the ignition switch replacement.

There are small retaining clips on the left hand switch pod that must be in place when the switches are installed.

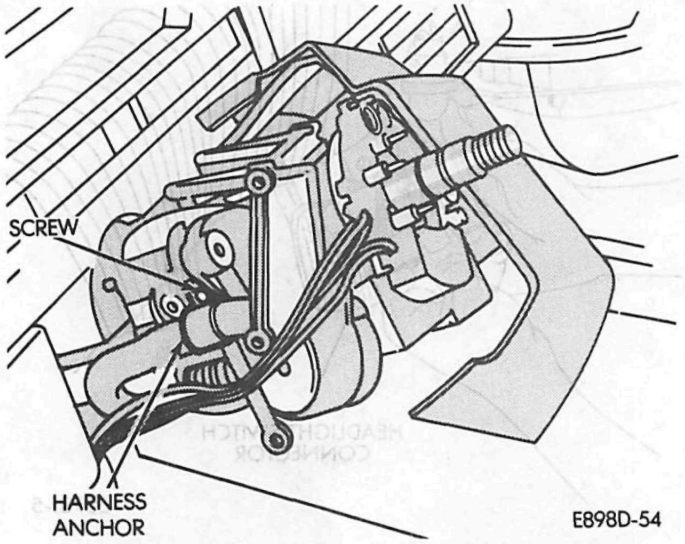


Fig. 13—Remove Harness Anchor

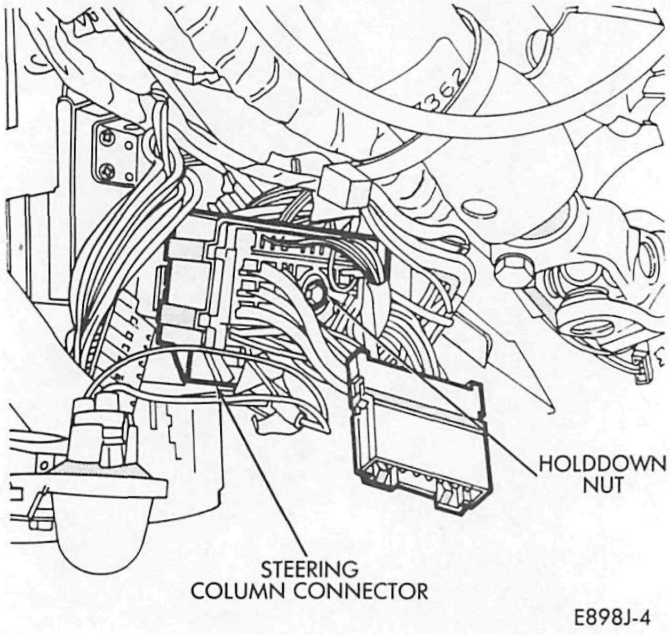


Fig. 14—Loosen Holddown Nut

(6) Align the pin (Fig. 16) on the turn signal cam with the pin bore in the steering wheel and start the wheel onto the steering shaft.

(7) Align the steering wheel with the reference mark on the steering shaft and seat the wheel on the shaft.

(8) Install and tighten the steering wheel nut to 70 N·m (52 ft. lbs.) torque.

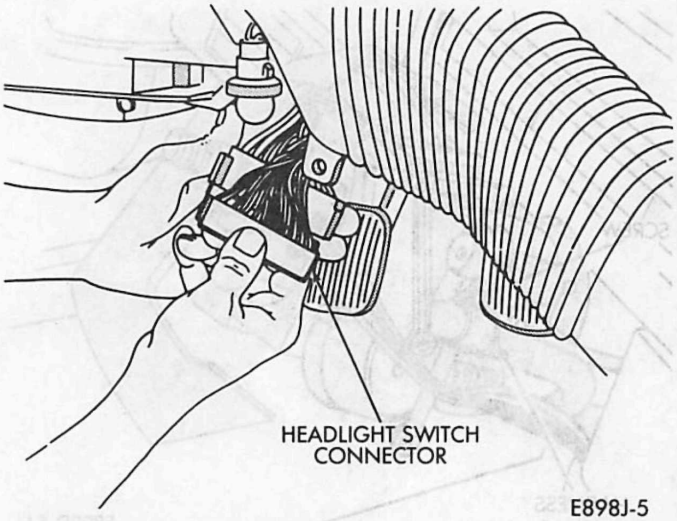


Fig. 15—Separate Switch Pod Connectors

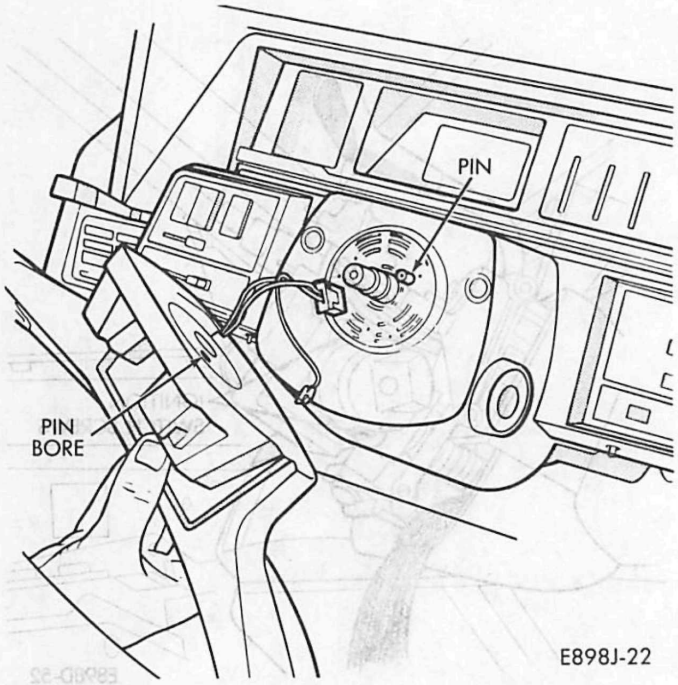


Fig. 16—Steering Wheel Alignment

PASSIVE SEAT BELTS

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GENERAL INFORMATION

The passive belt system consists of a control module, track and motor assemblies and a retractor assembly.

The basic operation of the system is to position the tab in its rear position when the ignition switch is on and the door switch is open to ground (door closed position). The control module will verify proper operation through the track position switches and the seat belt retractor switches.

The track is mounted to the A-pillar, roof rail and B-pillar. A drive cable runs from the lock box on the track to the motor located in the lower B-pillar. The upper torso belt release buckle is attached to a carrier that moves along the track.

The torso and lap belt retractors are located in the center console. The lap belt is buckled manually to the buckle located at the side sill.

TEST PROCEDURES

Passive seat belt systems may be tested using 2 different methods. One involves use of DRB II. If this test method is desired, refer to the Vehicle Diagnostic Test Procedures booklet. The other test method uses a volt/ohmmeter. The volt/ohmmeter method is described in the following tests.

Control Module

The control module is located in the trunk. The module looks at the front door jamb switches, vehicle speed, belt retractor switches, travelling tab position switches and the ignition switch to operate the system. After looking at all the inputs, the module then independently operates each track assembly through the front motor and rear motor relays of each track assembly.

The rate of speed sensor deceleration will prevent the carriers from being moved forward in case the doors open or the door switch circuits close to ground in an impact. The speed sensor signal rate overrides the door jamb switch to keep the restraints on. The belts would eventually be released by the module after its internal timer function is satisfied that the vehicle is truly stopped. The time interval varies with the deceleration rate seen by the module through the speed sensor signal.

The module will provide all the diagnostic information for the restraint system to the serial data network.

There are two power supplies for the module. Fuse 19 supplies power all the time and fuse 10 supplies power with the ignition on. Both fuses are 20 amp. The maximum current draw for the module with doors closed and the track motors off is 1 milliamp. With the ignition off and a door switch exit signal the module will energize the applicable front motor relay for 14 seconds to move the tab and belt forward. After those 14 seconds the module should go back to the dormant ignition off state. The module gets one ground through cavity 1 of the restraint module connector.

Track Assemblies

The track and motor assemblies attach to the body at 9 points across the door opening and down the "B" pillar. The motor is part of each assembly and is not serviced separately. There is an internal circuit breaker in each motor in case the track assembly jams. For additional protection the module will only energize each motor assembly for 14 seconds regardless of whether the switches agree that the tab got where it was supposed to or not. The track assembly includes the motor, the tab, the transporter, the front and rear track position switches and the lock box.

Motor Relays

The passive restraint system uses four relays for track motor control. Each motor (left and right) has its own pair of relays for forward and rearward movement. Each side has a front motor relay for moving the tab to the front or "A" position and a rear motor relay for moving the tab to the rear or "B" position. The relays are energized by the module. The power circuit they control is supplied by circuit breaker 23 on the fuse block which is rated at 30 amps. The relays are located under the front seat of the side that they control.

Door Jamb Switches

The control module looks at both front door jamb switches to operate the systems. The mod-

ule sends a 15 milliamp battery voltage sense signal to each switch. When the door is opened the switch becomes closed and the voltage to the module becomes zero on that particular door switch.

The door jamb switches are unique to passive restraint because they offer a parallel set of contacts to ground. The passive restraint door jamb switch contacts are in a common switch assembly but the contacts are separate from the courtesy lamp switch contacts. The door jamb switch circuits connect to the restraint module at cavity 12 for the right hand side and at cavity 35 for the left hand switch. Since the door jamb switches are dual contact the correct operation of the courtesy lamps does not mean that the door switches for the restraint system are functional. They can be tested with an ohmmeter. The circuit at the module connector should show greater than 3,000 ohms with the door closed (switch state open) and should show less the 50 ohms with the door open (switch state closed).

In a situation where the door jamb switch or switches fail the module will use vehicle speed as a back up "switch". If the speed sensing circuit shows 3 mph or greater, the module will move the carriers or tabs to their rear position whether the door switches indicate a closed door or not.

Carrier Switches

The carrier switches tell the restraint module the position of the carrier or travelling tab in the track assembly. There are two switches for each track assembly; a front position or "A" switch and rear position or "B" switch.

The front position or "A" switch is located in the motor assembly and is opened/closed based on how much track cable has been extended or retracted. The rear position or "B" switch is located in the lock box on the track and is opened/closed by the position of the carrier tab.

The control module supplies each sensing circuit of about 15 milliamps using battery voltage. The switches supply a ground path in their closed position. The circuit voltage should be high (12v) with the switch open and low (0) with the switch closed.

Front Position Switch "A"	Rear Position Switch "B"	Tab Or Carrier Position
Closed 0v	Open 12v	Tab or carrier in rear position
Open 12v	Closed 0v	Tab or carrier in front position
Closed 0v	Closed 0v	Tab or carrier leaving rear and moving to front
Closed 0v	Closed 0v	Tab or carrier leaving front and moving to rear

The carrier switches circuits can be tested at the restraint module connector. The left hand carrier front position switch circuit is cavity 27 and the rear position is cavity 28. The right hand carrier front position switch circuit is cavity 21 and the rear position is cavity 4. Circuit resistance in the open switch position should be greater than 3,000 ohms and resistance in the closed position should be less than 100 ohms.

Shoulder Belt Retractor Switches

The shoulder belt retractor switches tell the control module the position of the shoulder or torso belts. The switches are part of the shoulder belt retractor assembly and are not serviced separately. The switches are supplied approximately 15 milliamps by the module. The module sees belt position by reading the voltage state of the switch circuit.

The left hand shoulder belt switch is at cavity 6 and the right hand switch is at cavity 5. Circuit resistance in the open position should be greater than 3,000 ohms and resistance in the closed position should be less than 40 ohms. The retractor switch position voltages must agree with the carrier switch position voltages in the restraint module's logic program. If they disagree the warning lamp is turned on and remains on and the chime module will be activated for 4 to 8 seconds.

Switch Position	Shoulder Belt Position
Open 12v	Shoulder belt should be extended and connected to the carrier or tab
Closed 0v	Shoulder belt retracted and/or disconnected from the carrier

Lap Belt Switches

The lap belt switches are not part of the passive restraint system directly but, may cause the warning lamp to be turned on and can confuse diagnosis of the system. The chime module will operate the lamp for 60 seconds and cause a chime warning for 4 to 8 seconds if the lap belts are not fastened.

Lamp

The normal operation of the lamp is to illuminate for four to eight seconds on start up and be accompanied by a chime for that same time period.

DIAGNOSIS (Figs. 1, 2)

One Or Both Sides Do Not Operate Properly

Control Module Connectors Disconnected, Ignition Switch In RUN, Seat Belts Buckled, Doors Closed

TEST	OK	NOT OK
Measure resistance from Terminals 1, 4*, 21**, 27**, 28*	Zero ohms Mid position all measurements are zero	Repair open to ground
Measure resistance from Terminals 12, 35, 5 and 6	Open circuit Mid position all measurements are zero	Repair short
Measure voltage at Terminals 8 and 30	Battery voltage	Check fuses 10 and/or Fuse 19 and replace if necessary. If fuse is good, repair open to fuse block
With both seat belt carriers in the rear position, jumper Terminal 8 to Terminal 36 and then to Terminal 25	Both seat belt carriers move to the front position	Check
With both seat belt carriers in the front position, jumper Terminal 8 to Terminals 24 and 23	Both seat belt carriers move to the rear position	Go to step 4
Disconnect the speed sensor module and measure the continuity to Terminal 11	Good continuity. If continuity is good, replace the seat belt control module. If system still does not operate correctly, replace the speed sensor module, circuit breaker 23 and replace if necessary. If circuit breaker is good go to step 2	Repair wire

*Front Position
**Back Position

Seat belt Indicator And/Or Chime Module Does Not Operate Correctly With The Passive Restraint System

1. Seat Belt Control Module Terminals 6 and 34: Ignition Switch Turned From OFF To Vehicle Started And Torso Belts Buckled

TEST	OK	NOT OK
Terminal 34	Battery voltage	Replace Seat belt Control Module
Terminal 6	(For 4 to 8 seconds) If OK, replace chime module and/or check seat belt indicator and instrument cluster for an open	Check wires If wires are OK, replace the Seat belt Control module

2. LH or RH Front Motor Relay (Relay Disconnected): Seat belt Control Module Disconnected, Terminals 8 and 36 (RH) or 25 (LH) Jumped

TEST	OK	NOT OK
Terminals 4 and 5	Battery voltage	Repair open in wires
Measure resistance to ground from Terminals 2 and 3	Zero ohms. If OK, go to step 3	Repair open to ground
Terminal 1	Battery voltage	Replace relay

3. LH or RH Seat belt Motor Disconnected: Seat belt Control Module Disconnected and Terminals 8 and 25 (RH) or 36 (LH) Jumped

TEST	OK	NOT OK
Terminal C	Battery voltage	Repair from front motor relay
Measure resistance to ground to Terminal D	Zero ohms. If OK, replace the seat belt motor	Check wire for an open. If wire is good, go to step 4

4. LH or RH Back Motor Relay Disconnected: Seat belt Control Module Disconnected, Terminal 8 and 23 (RH) or 24 (LH) Jumped

TEST	OK	NOT OK
Terminals 4 and 5	Battery voltage	Repair open in wires
Measure resistance to ground from terminals 2 and 3	Zero ohms. If OK, replace the seat belt motor	Repair open in wire to ground
Terminal 1	Battery voltage	Replace relay

Seat belt Indicator Lamp Does Not Come On

Torso Belt Not Buckled

TEST	OK	NOT OK
Control Module Terminal 30	Battery voltage	Check for cause of open circuit
Control Module Terminal 1	Zero ohms	Check for cause of open circuit
Control Module Terminal 33	Battery voltage If OK, replace lamp	Terminals 6 and 5 closed circuit. If OK, replace module

Seat belt Indicator Does Not Go Off

Torso Belt Buckled

TEST	OK	NOT OK
Terminals 5 and 6	Open circuit If OK, replace module	Check for a short If OK, replace switch

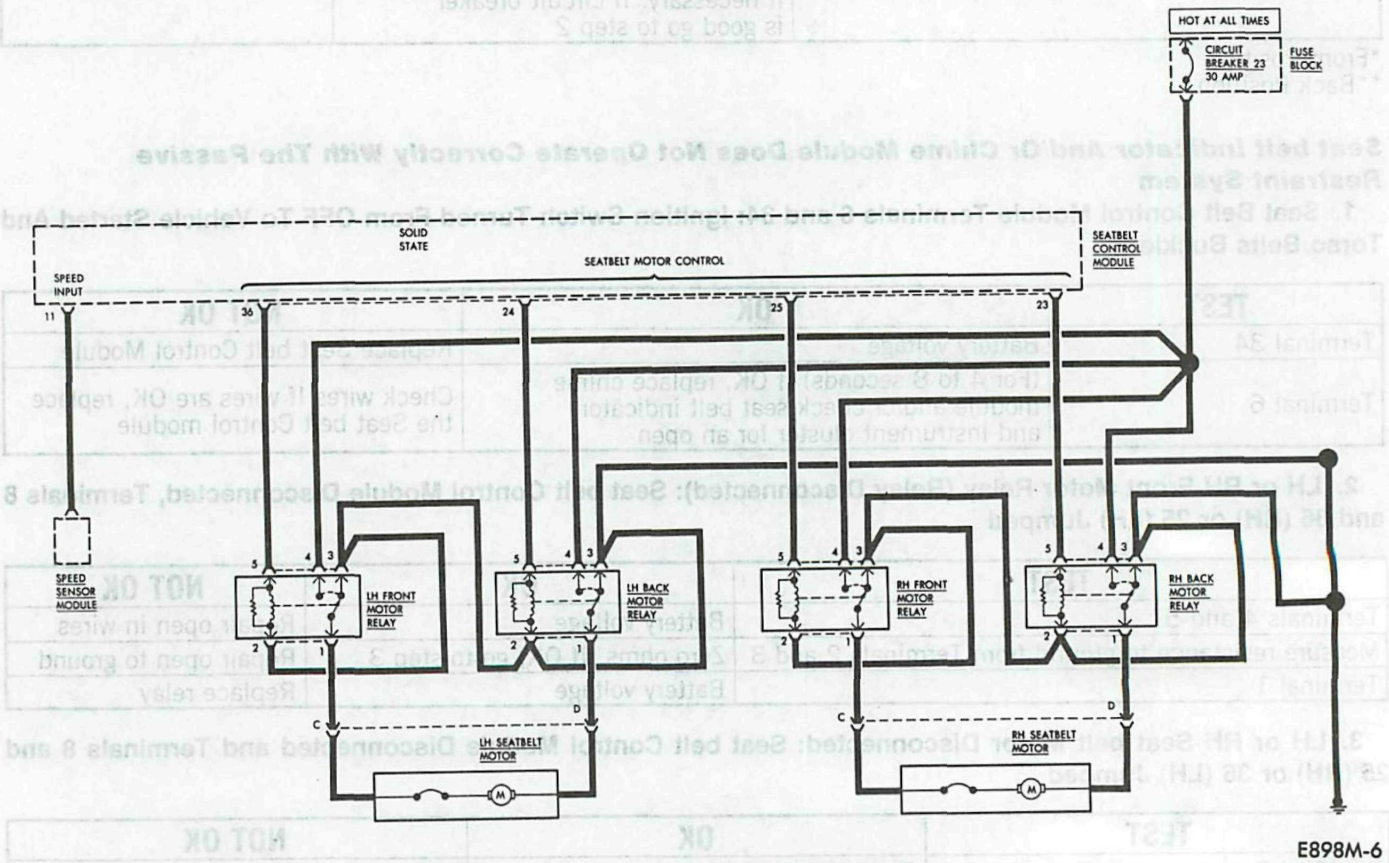


Fig. 1—Passive Restraint Schematic—Inputs

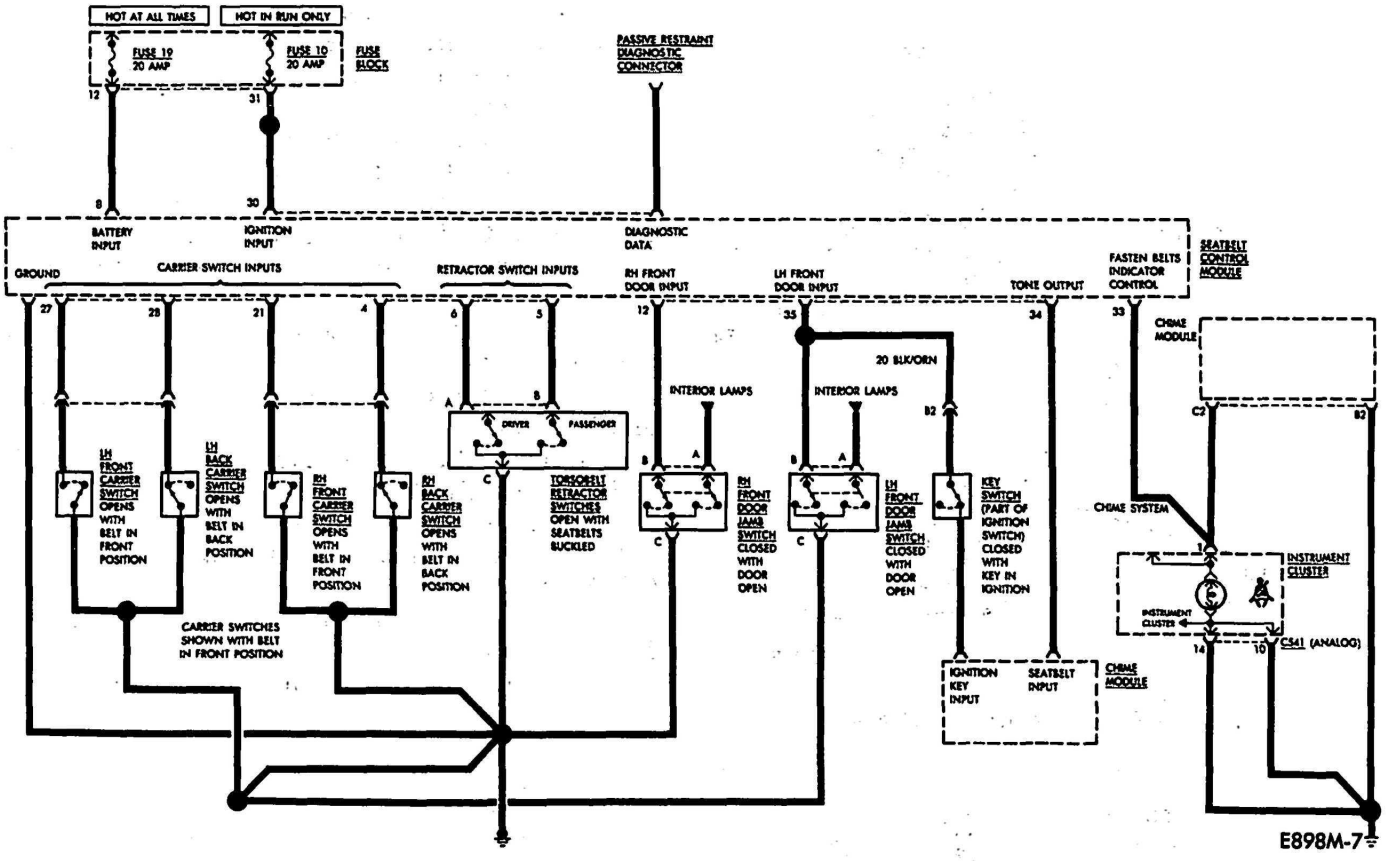


Fig. 2—Passive Restraint Schematic—Outputs

COMPONENT REPLACEMENT

Retractor Assembly
Removal and Installation

(1) Remove ash tray by pulling it up and out of ash tray receiver (Fig. 3).

(2) Remove screw holding ash tray receiver.

(3) Disconnect wire from cigar lighter.

(4) Remove two screws holding front of console to bracket.

(5) Remove three screws holding armrest assembly to the console.

(6) Remove the armrest assembly by pulling it up and out of the console.

(7) Remove two screws holding rear of console to bracket.

(8) Reach inside console and push out the seat belt guides.

(9) Remove the console.

(10) From under the vehicle remove two nuts and washers holding the seat belt anchor brace (Fig. 4).

(11) From inside the vehicle remove three torx head bolts holding the retractor assembly to the vehicle (Fig. 5).

(12) To install the retractor assembly, reverse the removal procedures.

- Tighten the three torx head bolts to 37 N·m (27 ft. lbs.).
- Tighten the two nuts holding the seat belt anchor brace to 35 N·m (26 ft. lbs.).

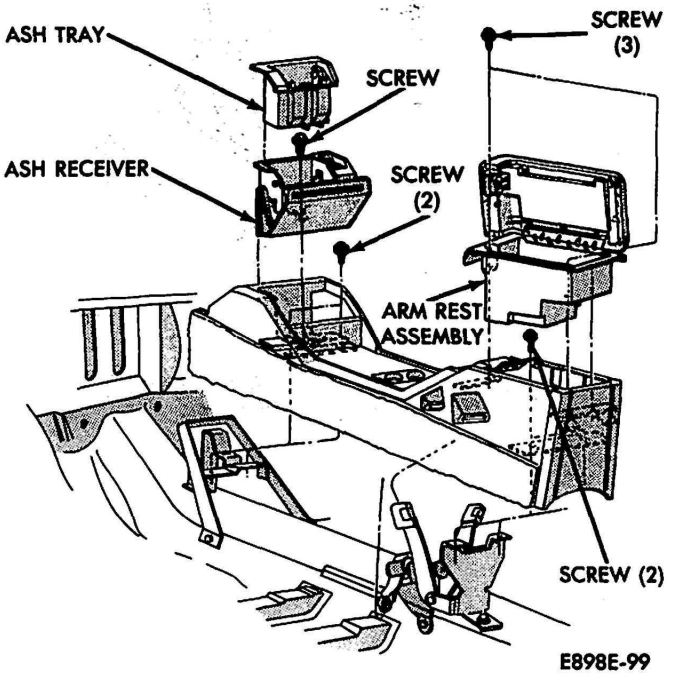


Fig. 3—Center Console Removal/Installation

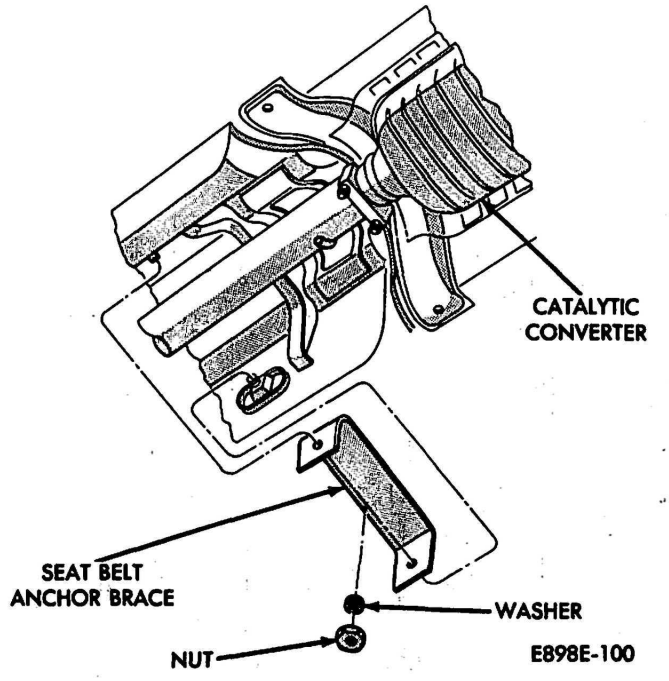


Fig. 4—Seat Belt Anchor Brace

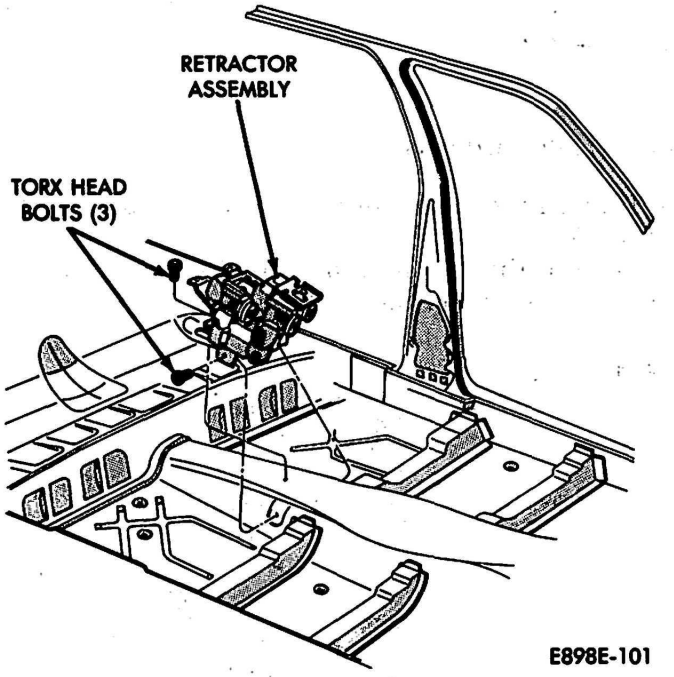


Fig. 5—Seat Belt Retractor Assembly Removal/Installation

Track and Motor Assembly Removal and Installation

(1) Remove the screws and the front door garnish molding.

(2) Remove the screws and the "B" pillar trim.

(3) Remove the screws holding the lower door opening trim and move the trim back enough to gain access to the motor mounting bolts (Fig. 6).

(4) Disconnect the electrical connector at the motor.

(5) Remove the screw and bolts holding the track to the door opening.

(6) Remove the bolts holding the motor track and lock box.

(7) Remove the entire track and motor assembly.

(8) To install the track and motor assembly, reverse the removal procedures.

(9) Torque the motor mounting bolts to 5 N·m (3.7 ft. lbs.).

(10) Torque the lock box mounting bolt to 33 N·m (24 ft. lbs.).

(11) Torque the track mounting bolts to 1.2 N·m (1 ft. lb.).

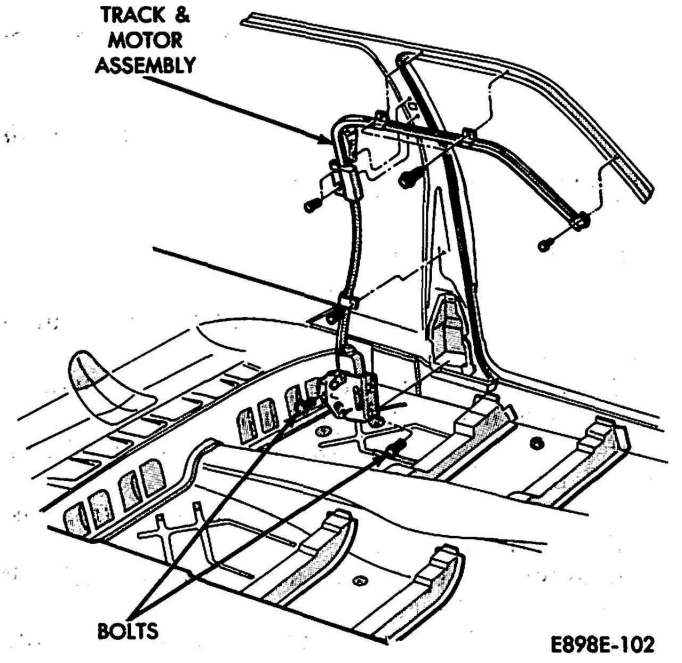


Fig. 6—Track and Motor Assembly Removal/Installation

REAR WINDOW DEFOGGER

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GENERAL

The rear window defogger clears condensation, frost, and light snow from the rear window.

Battery voltage is available at fuse 16 at all times and at fuse 8 with the ignition switch in RUN.

When the rear window defogger is turned on, the air control module receives an input from the right hand pod assembly. The air control module provides ground for the rear defogger relay which will energize and allow battery voltage from fuse 16 to be applied to the rear defogger. The air control module automatically turns the defogger off after approximately 10 minutes. Each subsequent defogger operation lasts about 5 minutes. If the rear defogger switch is pressed while the defogger is in operation, the defogger immediately shuts off.

The exact location of a break may be found by using a voltmeter. Refer to Electrical Troubleshooting.

Mopar No. 4267922 is a special varnish, with suspended silver particles, for repairing breaks in the elements.

ELECTRICAL DIAGNOSIS

REAR WINDOW DEFOGGER DOES NOT OPERATE (Fig. 1)

1. Fuse: Ignition Switch in RUN

TEST	OK	NOT OK
Not blown	Repair faulty fuse	Check Fuse 8 and 16
Battery side of fuse 16	Battery voltage	Repair open to ignition switch

2. Defogger Grid: Engine Running, Defogger Switch ON

TEST	OK	NOT OK
Connector A (Fig. 2)	10.6 volts	Under 10.6 volts go to test 3: Relay. 12 to 14 volts, repair open to ground.
Contact each grid at approximate centerline of window	Approximately 6 volts on all grids	10.6 volts at centerline indicates a break in grid between centerline and ground. Zero volts at centerline indicates a break in grid between centerline and connector A. If not approximately 6 volts, repair grid as described. See NOTE below.

NOTE: The exact location of the break can be pinpointed by moving the positive voltmeter lead to the left or right along the grid until an abrupt change in the voltage reading is noticed (Figs. 3, 4). The break is at that point in the grid.

3. Relay: Ignition Switch in RUN and Rear Window Defogger Switch ON

TEST	OK	NOT OK
Rear Defogger Relay - Terminal 1	Battery voltage	Repair open from fuse 16
Rear Defogger Relay - Terminal 2	Battery voltage	Repair open from fuse 8
Rear Defogger Relay - Terminal 5	Battery voltage	Replace relay
Rear Defogger Relay - Terminal 4	Battery voltage	Replace relay

4. Air Control Module and Right Hand Pod

TEST	OK	NOT OK
Check circuits connected to air module and Right Hand pod	Replace the air control module with a known good air control module, If defogger operates properly replace the air control module. If the defogger does not operate, replace the RH pod.	Repair as needed

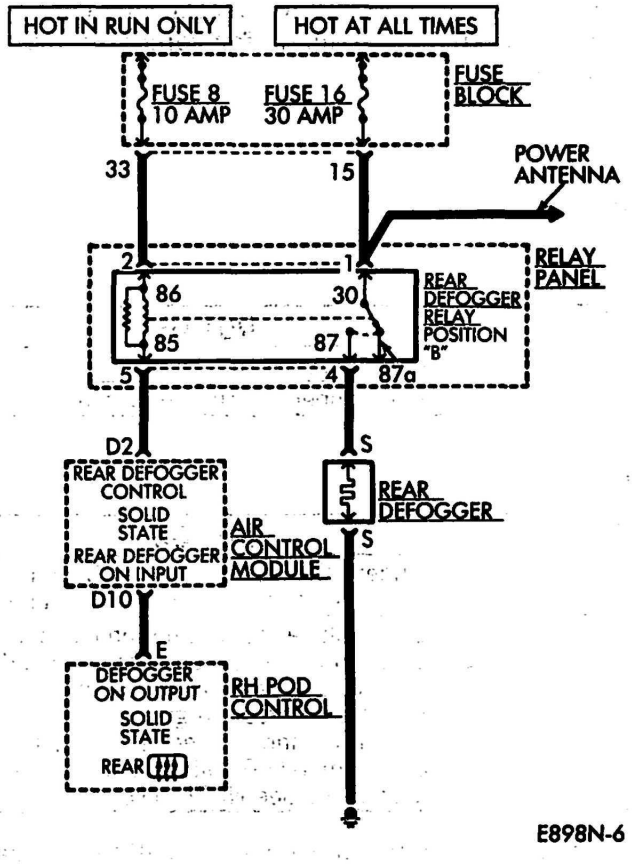


Fig. 1—Rear Defogger Wiring Diagram

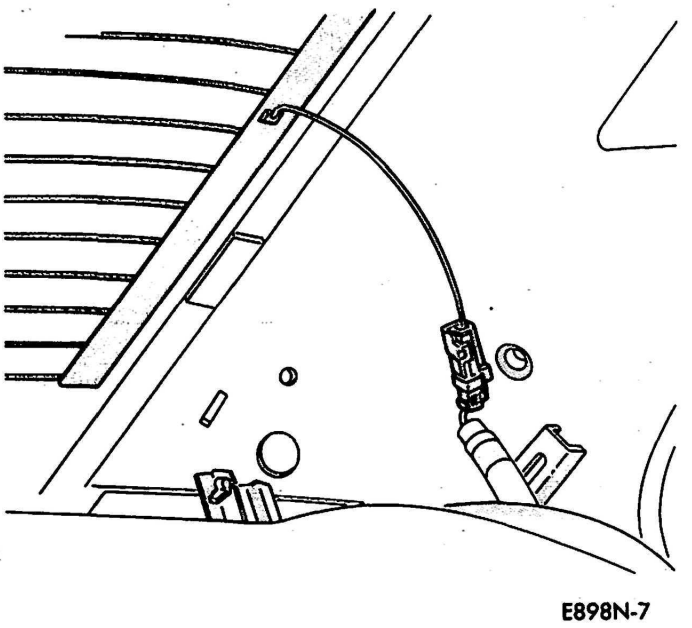


Fig. 2—Rear Window Defogger Connector

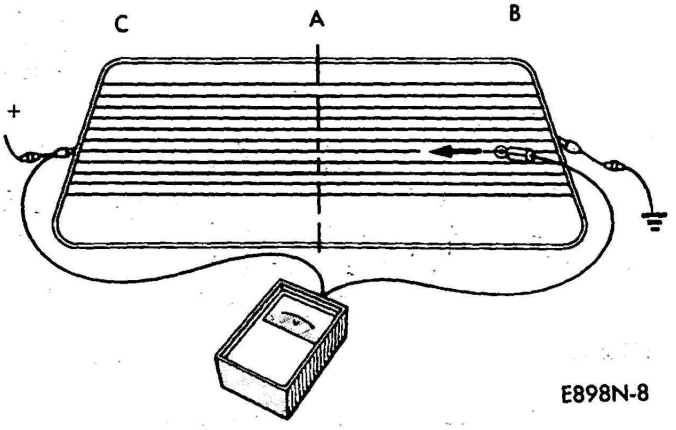


Fig. 3—Defogger Grid Inspection Ground Side

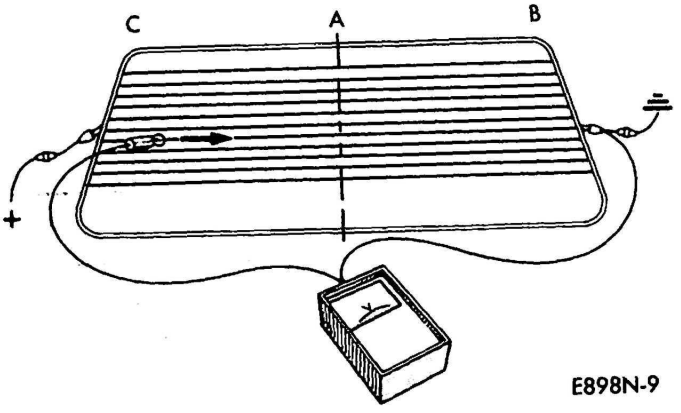


Fig. 4—Defogger Grid Inspection Power Side

GRIDLINE REPAIR

(1) Clean the area to be repaired preferably with methylated spirits or with window cleaning fluid and wipe with a clean, dry cloth to remove all traces of dust or grease.

(2) Place a strip of adhesive tape along each side of the resistive element to serve as a mask during retouching (Fig. 5).

(3) Remove package separator clamp and mix plastic conductive epoxy thoroughly. Fold in half and cut center corner to dispense epoxy.

(4) Apply conductive epoxy through slit in masking tape. Overlap both ends of the break by 19mm (3/4 inch).

(5) For a terminal or pigtail replacement, mask adjacent areas so epoxy can be extended onto line as well as bus bar. Apply a thin layer of epoxy to area where terminal was fastened and to adjacent line.

Apply a thin layer of conductive epoxy on terminal and place terminal on desired location. To prevent terminal from moving while the epoxy is curing, it must be wedged or clamped.

(6) Carefully remove masking tape from grid line. Lift the tape up carefully at right angles to the strip in the direction of the arrow (Fig. 6).

CAUTION: DO NOT allow the glass surface to exceed 400°F, or glass may fracture.

(7) Allow epoxy to cure 24 hours at room temperature or use heat gun with a 260°-371°C (500°-700°F) range for 15 minutes. Hold gun approximately 254mm (10 inches) from repaired area.

(8) After conductive epoxy is properly cured, remove wedge from terminal and check out operation of rear window defogger. Do not attach connectors until curing is complete.

WARNING: REPAIR KIT MAY CAUSE SKIN OR EYE IRRITATION.

CONTAINS EPOXY RESIN AND AMINE TYPE HARDENER, HARMFUL IF SWALLOWED. AVOID CONTACT WITH SKIN AND EYES. FOR SKIN, WASH AFFECTED AREAS WITH SOAP AND WATER. DO NOT TAKE INTERNALLY. IF TAKEN INTERNALLY, INDUCE VOMITING; CALL A PHYSICIAN IMMEDIATELY. IF IN CONTACT WITH EYES, FLUSH WITH PLENTY OF WATER. USE WITH ADEQUATE VENTILATION. DO NOT USE NEAR FIRE OR FLAME. CONTENTS CONTAIN 3 FLAMMABLE SOLVENTS.

WARNING: KEEP OUT OF REACH OF CHILDREN.

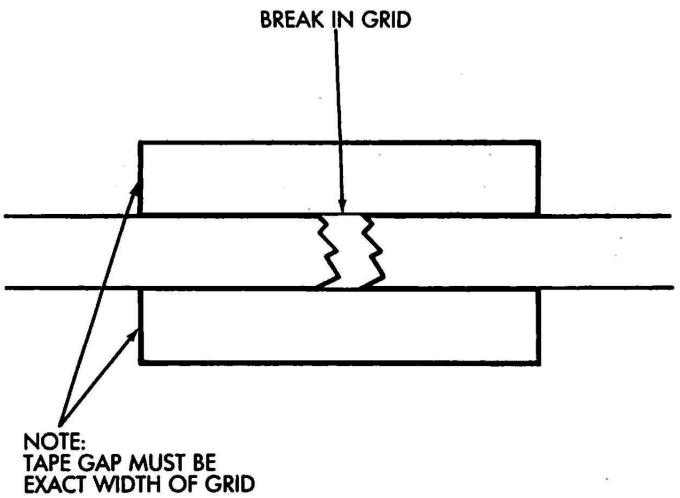


Fig. 5—Mask Element Before Repair (Exploded View)

REAR WINDOW DEFOGGER RELAY

The rear window defogger relay is located under the center of the instrument panel in the relay block (Fig. 7).

To remove the relay, remove the relay cover and unplug the relay.

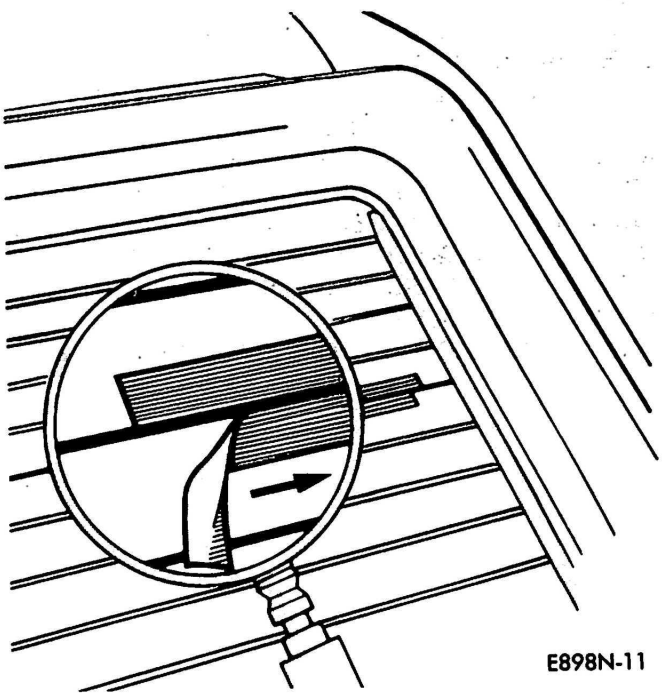


Fig. 6—Remove Tape At Right Angle

REAR WINDOW DEFOGGER SWITCH

Refer to Group 24; Control Devices, Heat/AC Pod Removal.

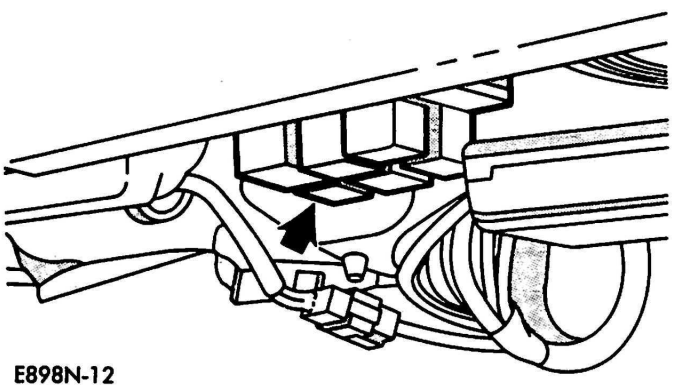


Fig. 7—Rear Window Defogger Relay

POWER LOCKS

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POWER DOOR LOCKS

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DIAGNOSIS (Figs. 1, 2)

General Information

Power from Fuse 2 is available at all times to the keyless entry module, the master door lock/power window switch, and the door key lock switches. Circuit breaker 22 applies battery voltage at all times to the door lock relay.

Closing one of the door lock or master door lock/power window switch LOCK switches allows battery voltage to be applied to terminal 1 of the door lock relay. This energizes the lock coil, allowing current to flow from terminal 5 through the normally open lock contacts to terminal 4 of the door lock relay.

Ground is provided at terminal 2 of the door lock relay. The door lock relay then allows ground to be provided to the door lock motors through the closed contacts of the UNLOCK switch to terminal 6 of the door lock relay.

Closing one of the door lock UNLOCK switches allows battery voltage to be applied to terminal 3 of the door lock relay. This energizes the unlock coil, allowing current to flow from terminal 5 through the normally open unlock contacts to terminal 6 of the door lock relay.

Ground is provided at terminal 2 of the door lock relay. The door lock relay then allows ground to be provided to the door lock motors through the close contacts of the lock switch to terminal 4 of the door lock relay.

Keyless Entry

The keyless entry feature is optional. A radio-controlled electronic device consisting of a transmitter and receiver is used for locking and unlocking the doors from outside the vehicle. The receiver is located above the windshield and is supplied with voltage from Fuse 2. This system is operated by pointing the transmitter toward the windshield and depressing the button on the transmitter. As the button is depressed, an electronic signal is transmitted to the receiver. The receiver then converts the signal to electrical energy which activates the door lock relay.

All Power Door Locks: Inoperative

1. Battery Feed

TEST	OK	NOT OK
Inspect Fuse 2	Not blown	Replace Fuse 2
Battery side of fuse	Battery voltage	Repair open to battery
Inspect Circuit Breaker 22	Not blown	Replace circuit breaker 22
Door Lock Relay connector - Terminal 5	Battery voltage	Repair open to fuse block

2. Door Lock Relay: Relay Removed

TEST	OK	NOT OK
Door Lock Relay connector - Terminal 2 to ground	Zero ohms	Repair open to ground
Door Lock Relay connector - Terminal 1 (door lock switch in LOCK position)	Battery voltage	Repair open to fuse block
Door Lock Relay connector - Terminal 3 (door lock switch in UNLOCK position)	Battery voltage	Repair open to fuse block
Jumper Door Lock Relay connector - Terminal 1 to Terminal 4 and jumper Terminal 6 to Terminal 2 (door lock switch in LOCK position)	Doors lock. If OK, replace relay	Go to next step
Jumper Door Lock Relay connector - Terminal 3 to Terminal 6 and jumper Terminal 4 to Terminal 2 (door lock switch in UNLOCK position)	Doors unlock. If OK, replace relay	Install relay. Go to next test

One Door Lock Motor Inoperative

Circuit Check: Any Door Key Lock Switch In The Lock Position

TEST	OK	NOT OK
Insert a voltmeter in place of the motor	Battery voltage. Replace motor	Repair open in circuits between the motor and splices V and M

Door Locks Inoperative From One Switch

Circuit Check

TEST	OK	NOT OK
Power terminal of inoperative switch	Battery voltage	Repair open from fuse panel
Unlock terminal of switch (switch in UNLOCK position	Battery voltage. If OK, repair open to door lock relay	Replace switch
Lock terminal of switch (switch in LOCK position)	Battery voltage. If OK, repair open to door lock relay	Replace switch

Keyless Entry Inoperative

Circuit Check

TEST	OK	NOT OK
Replace battery in transmitter Check operation.	Door locks unlock and lock Return vehicle to customer	Go to next step
Keyless Entry Module connector - Terminal A	Battery voltage	Repair open from Fuse 2
Keyless Entry Module connector disconnected - Terminal H	Zero ohms	Repair open to ground
Jumper lead Keyless Entry Module connector - Terminal A to Terminal G then Terminal A to Terminal B	Doors lock and unlock. Replace keyless entry module	Repair open from Keyless Entry Module connector to connector A

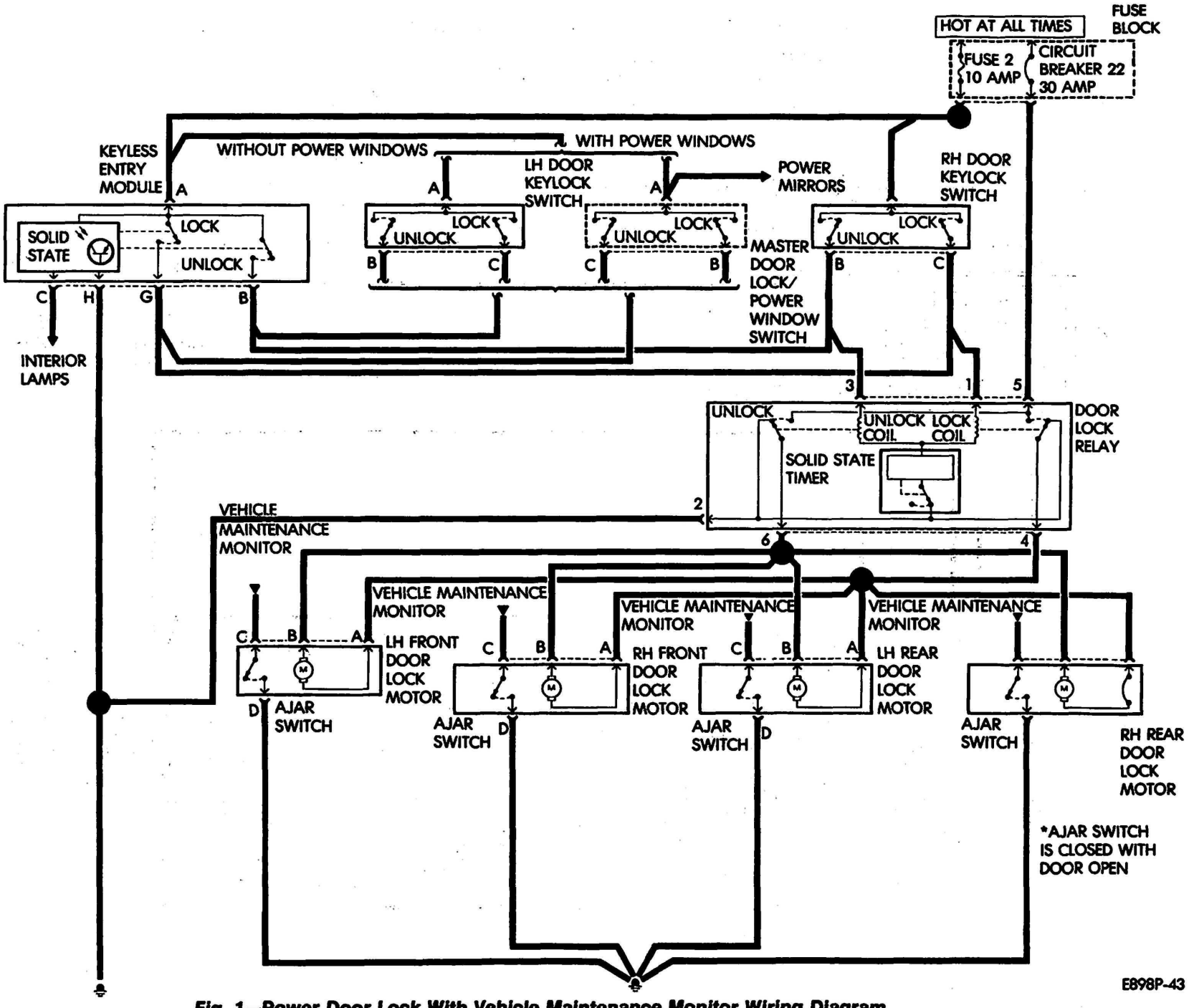


Fig. 1—Power Door Lock With Vehicle Maintenance Monitor Wiring Diagram

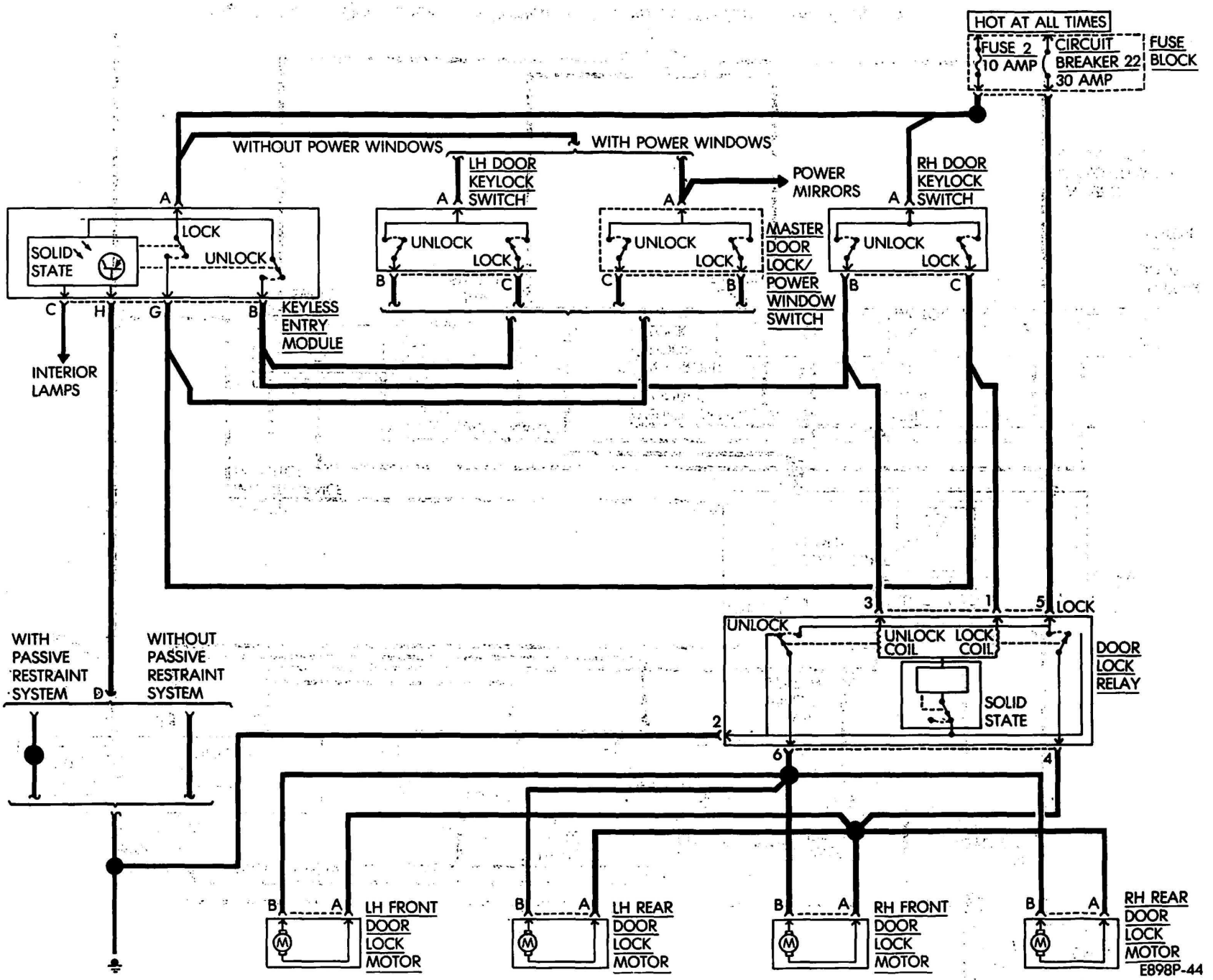


Fig. 2—Power Door Lock W/O Vehicle Maintenance Monitor Wiring Diagram

ACTUATOR

Removal

(1) Lower the window and disconnect battery negative cable.

(2) Remove lock button by pressing locking tab (Fig. 3) and lifting button.

(3) Remove the plastic switch cover (Figs. 4, 5) by prying up the rear of the cover. Once the rear of the cover is free, move the cover to the rear.

(4) Remove Door handle attaching screws (Fig. 6, 7).

(5) Lift door handle/mirror switch up and out of door.

(6) Disconnect electrical connector (Fig. 8).

(7) Remove switch and door panel attaching screws (Figs. 6, 9, 10).

(8) Lift switch assembly up and disconnect electrical connectors (Figs. 11, 12).

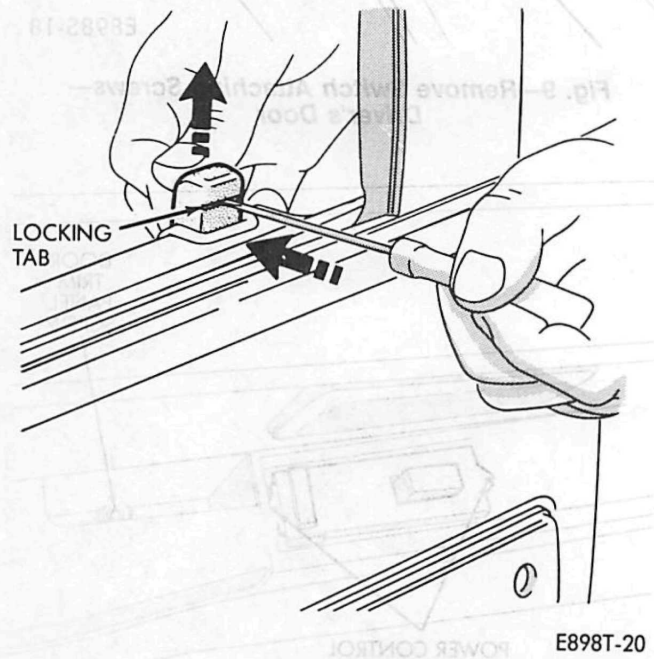


Fig. 3—Remove Door Lock Button

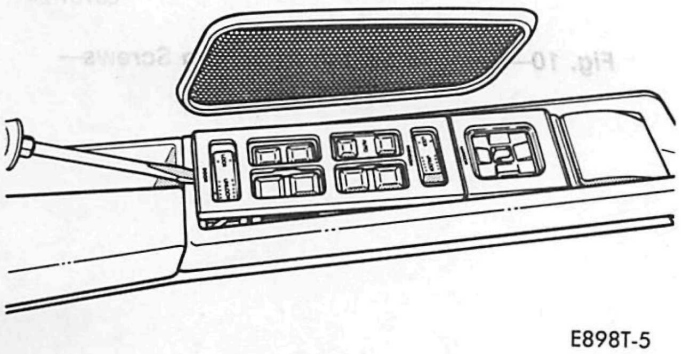


Fig. 4—Remove Switch Cover—Driver's Door

(9) Pry upper corner of bezel out 1/8" to disengage the locator tab from the locator hole in the mirror control retainer (Fig. 13), then slide the mirror bezel up to remove (if corner of bezel is pried out more than 1/8" bezel retaining tabs will break off).

(10) Remove the door trim panel. Pry the trim panel loose from the door inner panel with a trim clip remover (Fig. 14). Lift the panel from the door.

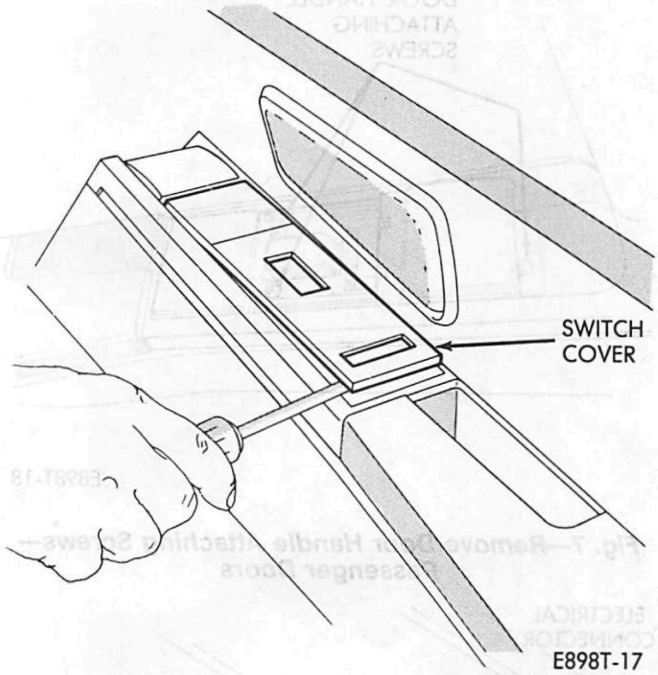


Fig. 5—Remove Switch Cover—Passenger Doors

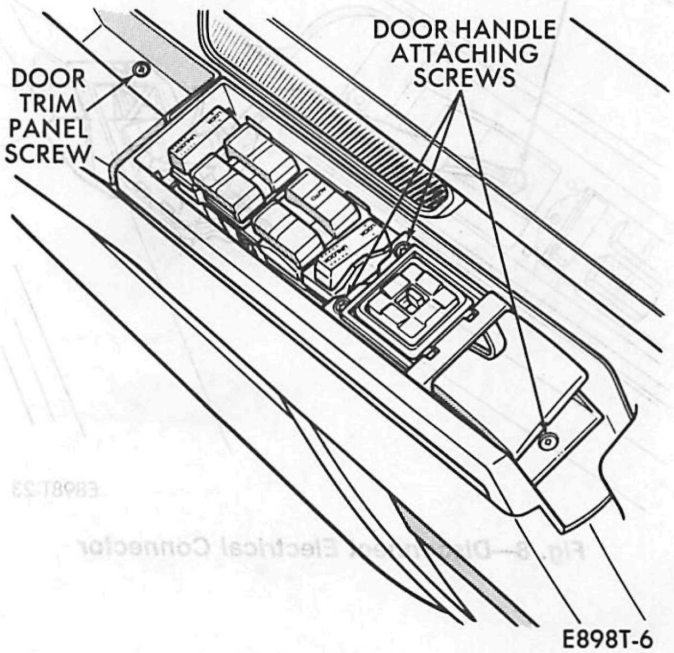


Fig. 6—Remove Door Handle Attaching Screws—Driver's Door

(11) Remove plastic door liner (water dam) from door.
(12) Disconnect electrical connector (Fig. 15).
(13) Remove the torx head screws (Fig. 16) securing the power latch mechanism.
(14) Disconnect two linkage clips (Fig. 17).
(15) Pry lock rod (Fig. 17) out of holder.
(16) Remove the latch mechanism from the door.

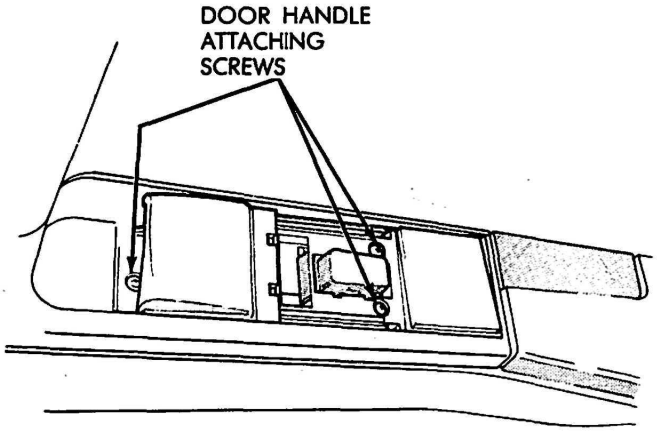


Fig. 7—Remove Door Handle Attaching Screws—Passenger Doors

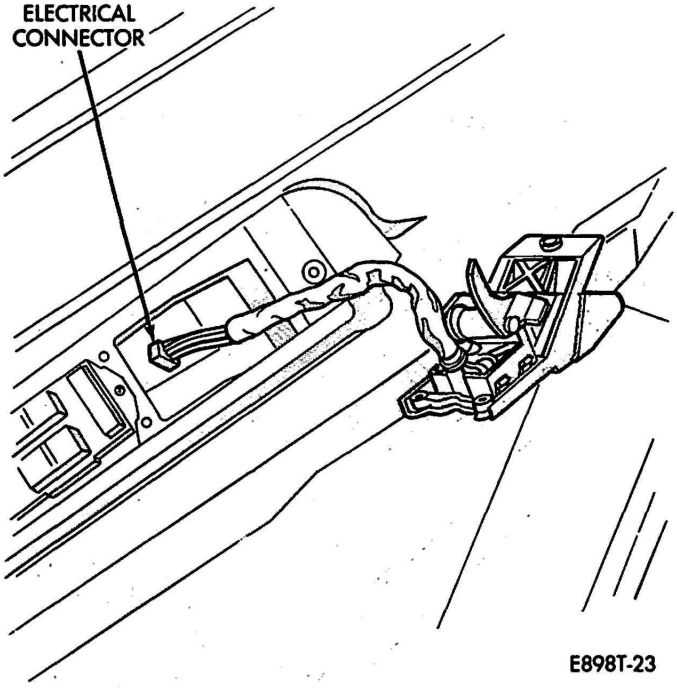


Fig. 8—Disconnect Electrical Connector

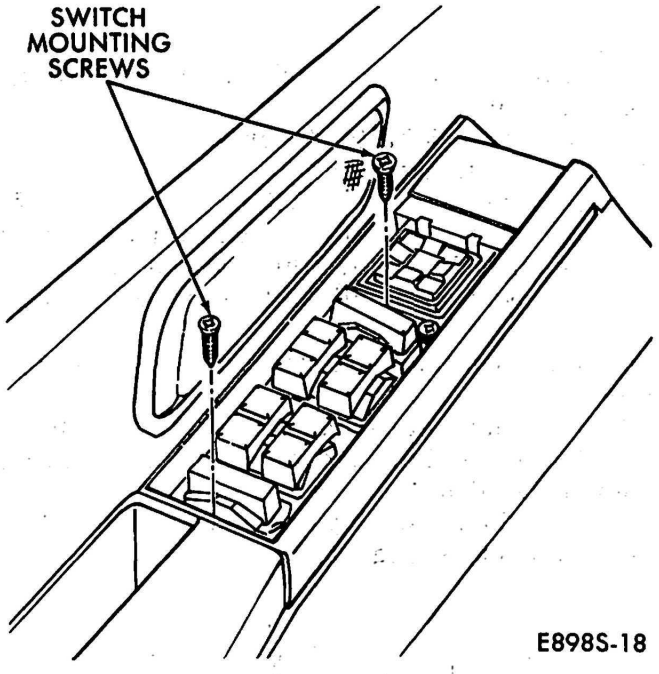


Fig. 9—Remove Switch Attaching Screws—Driver's Door

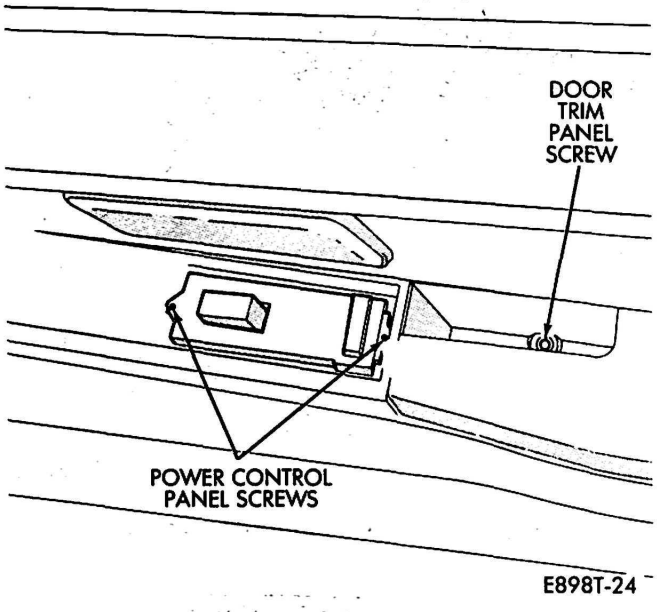


Fig. 10—Remove Switch Attaching Screws—Passenger Door

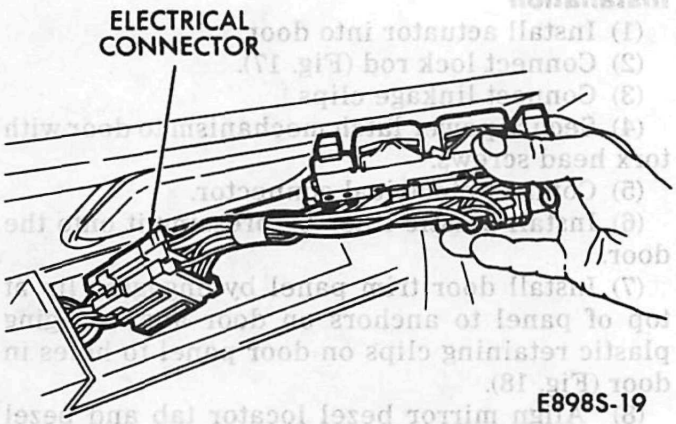


Fig. 11—Disconnect Electrical Connectors—Driver's Door

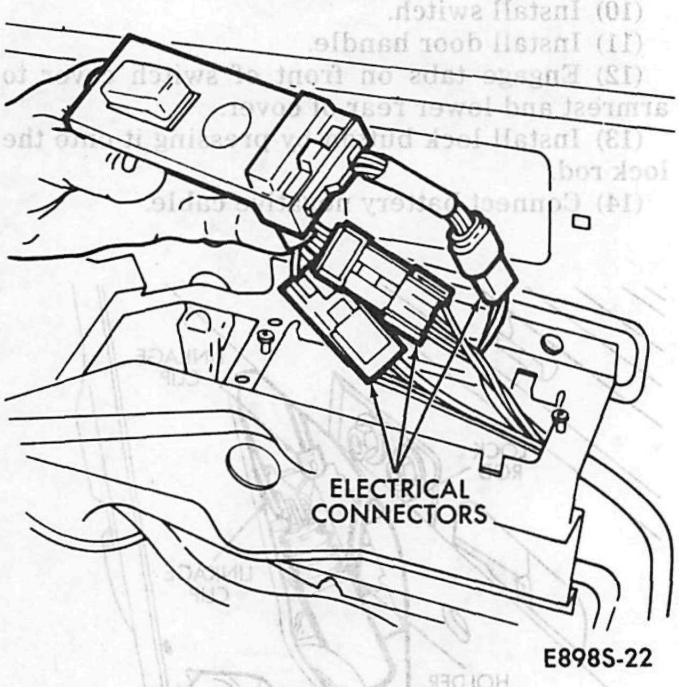


Fig. 12—Disconnect Electrical Connectors—Passenger Door

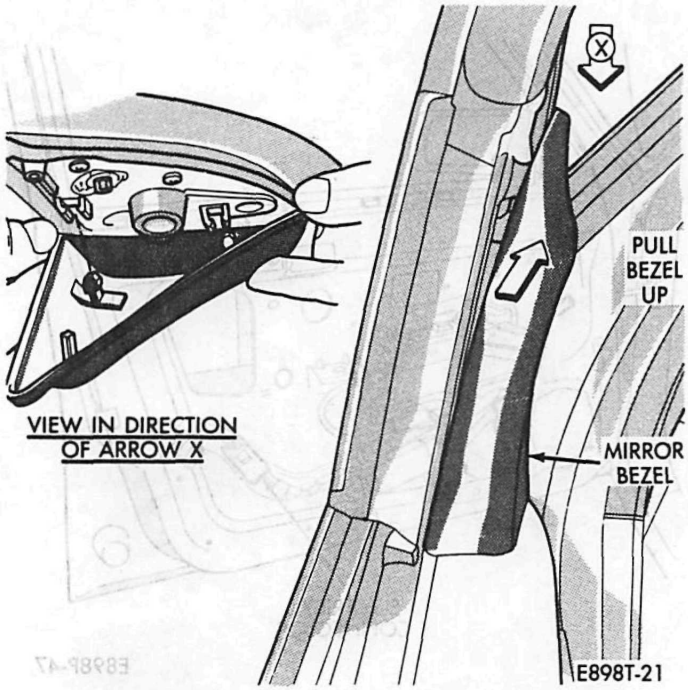


Fig. 13—Remove Mirror Bezel

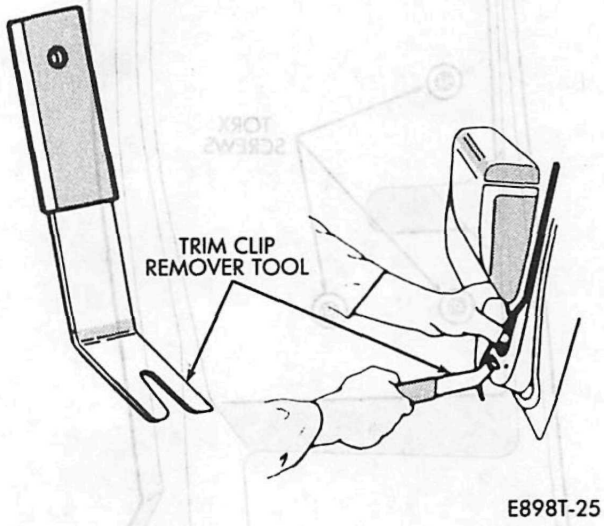


Fig. 14—Remove Door Trim Panel

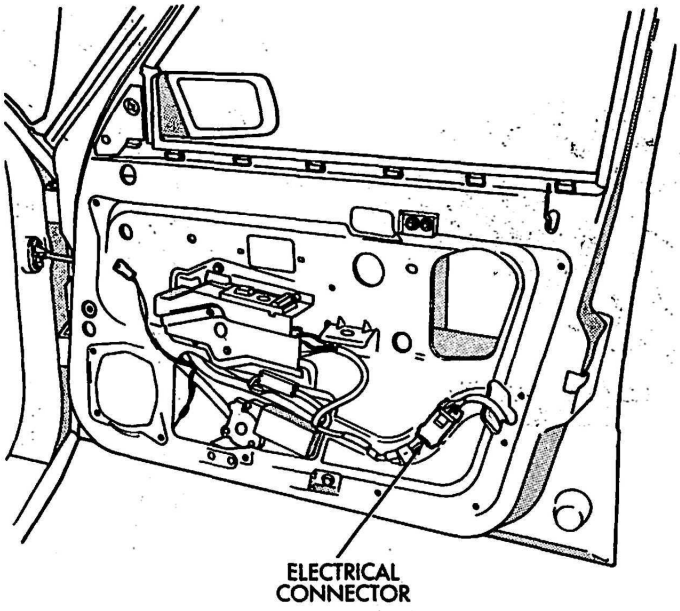


Fig. 15—Disconnect Electrical Connector

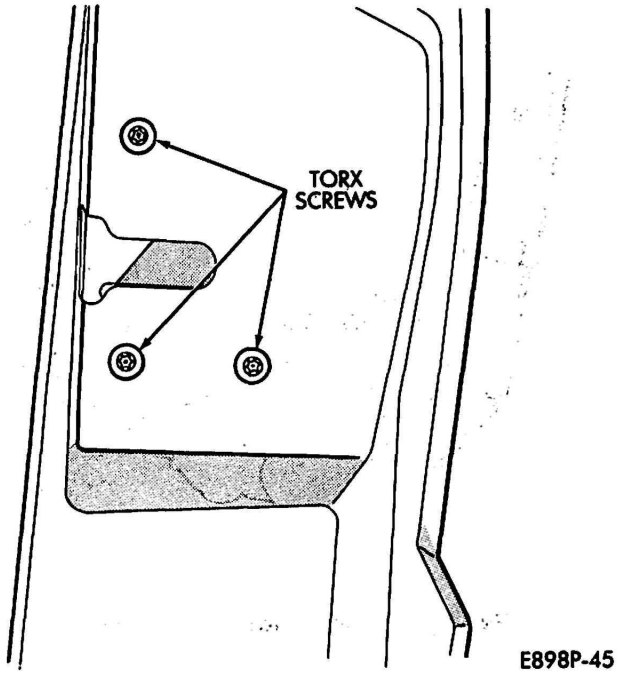


Fig. 16—Remove Latch Mechanism

Installation

(1) Install actuator into door.
(2) Connect lock rod (Fig. 17).
(3) Connect linkage clips.
(4) Secure power latch mechanism to door with torx head screws.
(5) Connect electrical connector.
(6) Install plastic liner by pressing it onto the door.
(7) Install door trim panel by engaging lip at top of panel to anchors on door and engaging plastic retaining clips on door panel to holes in door (Fig. 18).
(8) Align mirror bezel locator tab and bezel attaching tabs into the mirror control retainer and snap bezel into place.
(9) Connect switch assembly.
(10) Install switch.
(11) Install door handle.
(12) Engage tabs on front of switch cover to armrest and lower rear of cover.
(13) Install lock button by pressing it onto the lock rod.
(14) Connect battery negative cable.

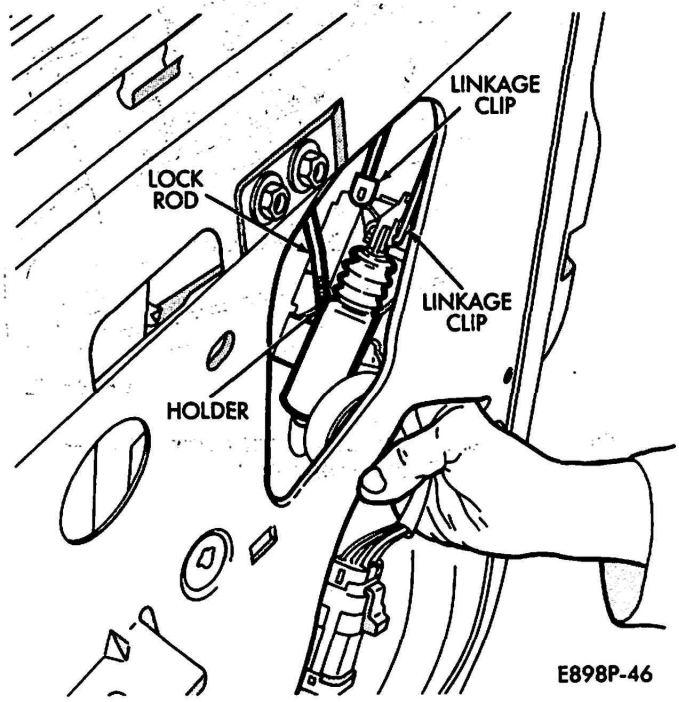


Fig. 17—Disconnect Linkage Clips

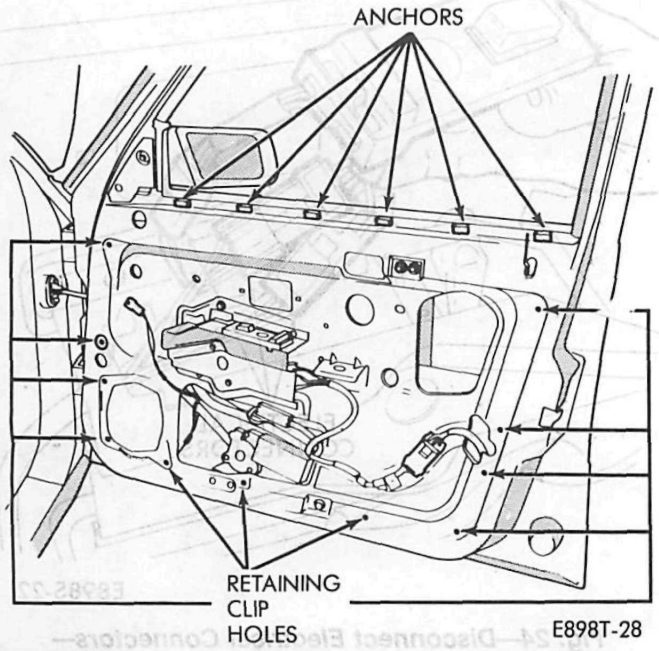


Fig. 18—Door Trim Panel Installation

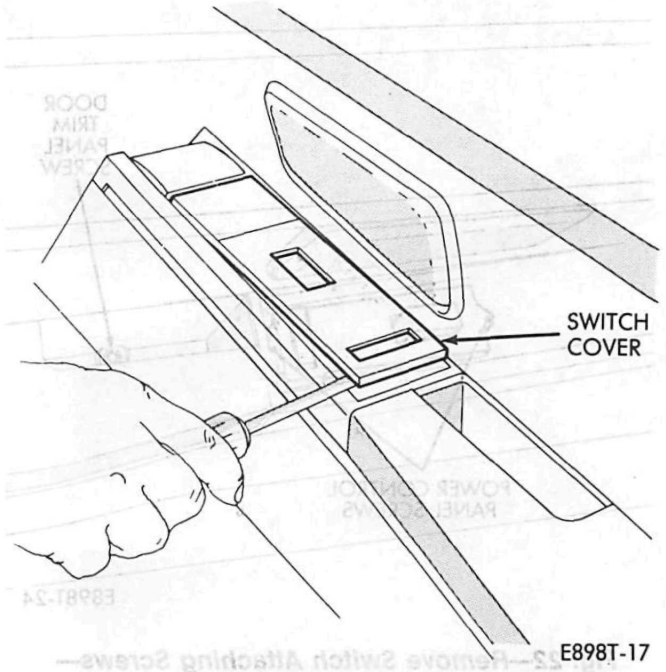


Fig. 20—Remove Switch Cover—Passenger Doors

SWITCH

Removal

(1) Disconnect battery negative cable.

(2) Remove the platic switch cover (Figs. 19, 20) by prying up the rear of the cover. Once the rear of the cover is free, move the cover to the rear.

(3) Remove switch attaching screws (Figs. 21, 22).

(4) Lift switch assembly up and disconnect electrical connectors (Figs. 23, 24).

Installation

(1) Connect electrical connectors.

(2) Lower switch assembly into place and secure with screws.

(3) Engage tabs on front of switch cover to armrest and lower rear of cover.

(4) Connect battery negative cable.

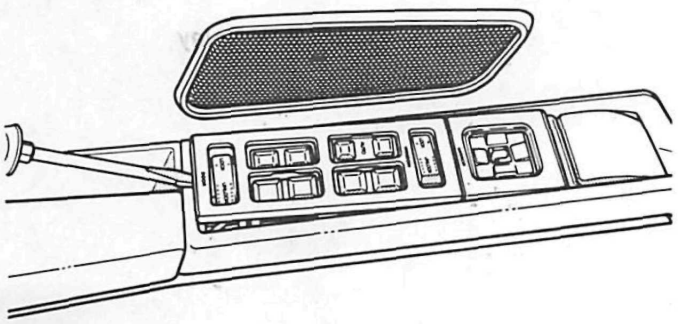


Fig. 19—Remove Switch Cover—Driver's Door

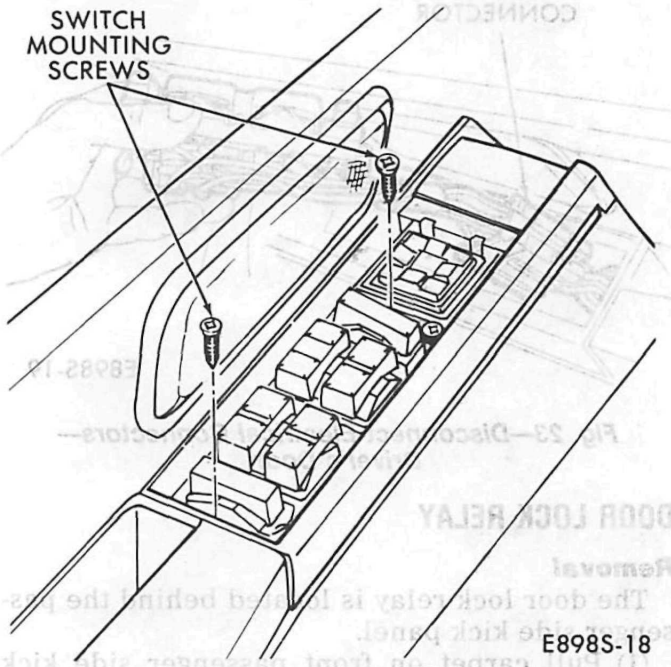


Fig. 21—Remove Switch Attaching Screws—Driver's Door

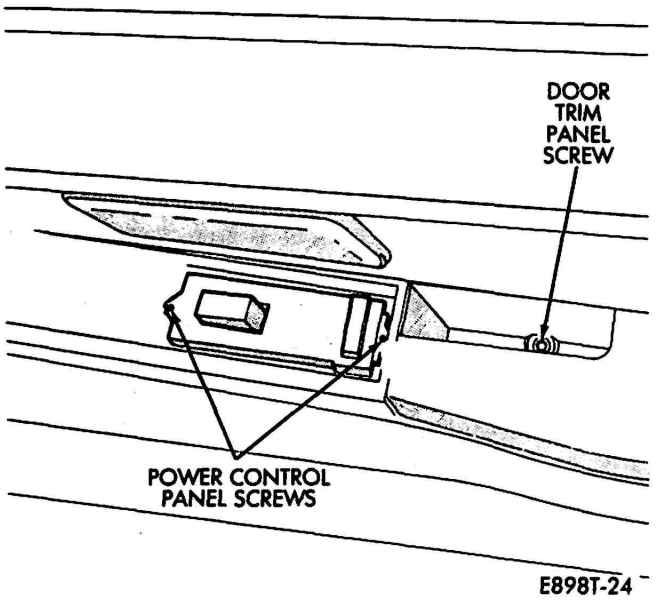


Fig. 22—Remove Switch Attaching Screws—Passenger Door

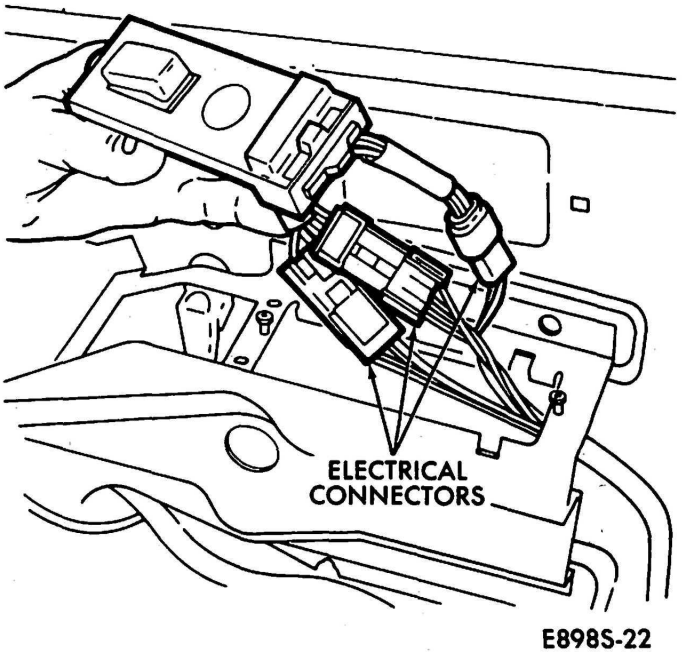


Fig. 24—Disconnect Electrical Connectors—Passenger Door

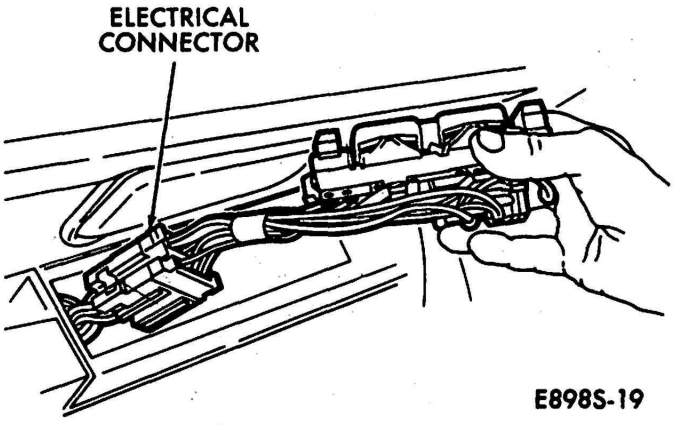


Fig. 23—Disconnect Electrical Connectors—Driver's Door

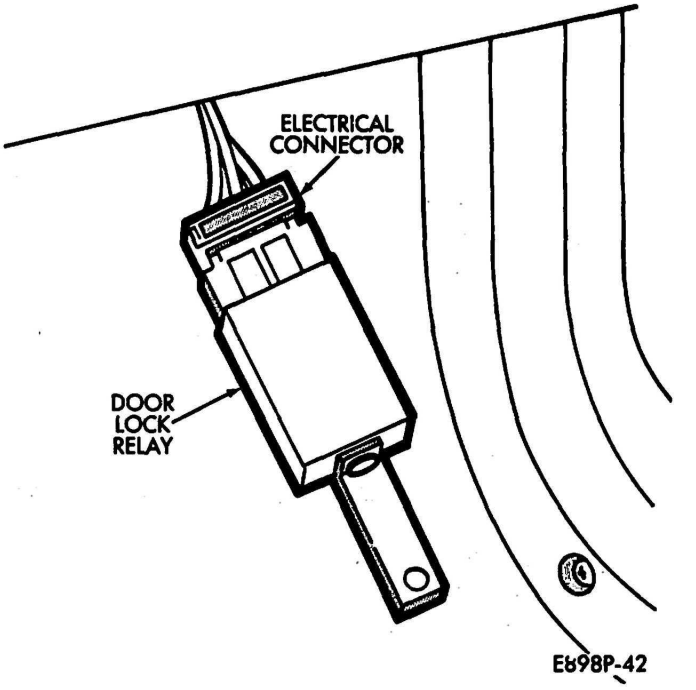


Fig. 25—Door Lock Relay

DOOR LOCK RELAY

Removal

The door lock relay is located behind the passenger side kick panel.

(1) Pull carpet on front passenger side kick panel to expose the door lock relay (Fig. 25).
(2) Remove the screw holding the relay in place.
(3) Disconnect electrical connector.

Installation

(1) Connect electrical connector.
(2) Position relay and secure with screw.
(3) Put carpet back into proper position.

KEYLESS ENTRY

GENERAL INFORMATION

The transmitter will lock or unlock all door locks at once. In addition, once door locks are locked or unlocked the interior courtesy lamps will turn on automatically. The lamps will remain on for approximately 15 seconds.

The receiver will only respond to a correctly coded (keyed) transmitter. If a transmitter becomes damaged or is lost, replacement of the transmitter will be necessary. Refer to Receiver for code location.

For diagnostic information refer to Power Door Locks.

TRANSMITTER

Operation

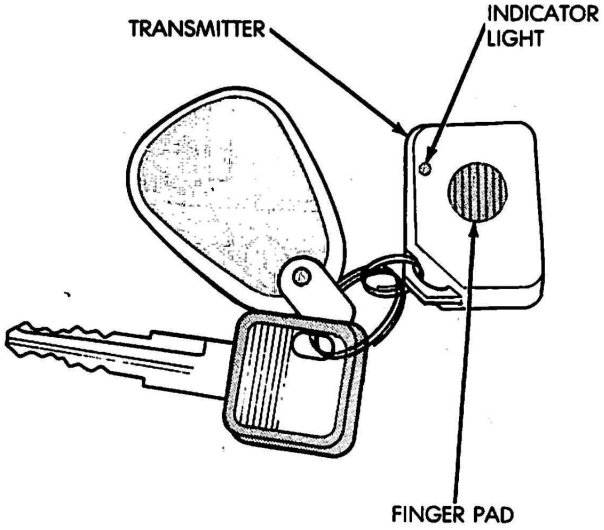
Press the transmitter (Fig. 1) on the finger pad to activate the transmitter. The indicator light glows when the unit is transmitting, indicating that the transmitter batteries are properly charged.

Batteries

Battery life is approximately one year. When batteries require replacement, replace them with two CR 2016 batteries (Fig. 2), PN 8983 504 802.

Code Location

To obtain the code number required for replacement of the transmitter, inspection of the transmitter or receiver will be necessary. Refer to Receiver Removal for receiver code location.



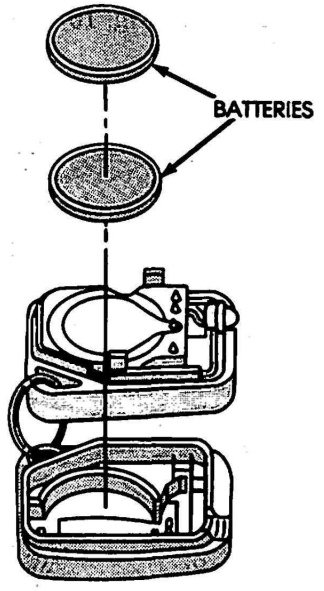
J898P-16

Fig. 1—Keyless Transmitter

(1) Separate the transmitter at the middle seam (Fig. 3).

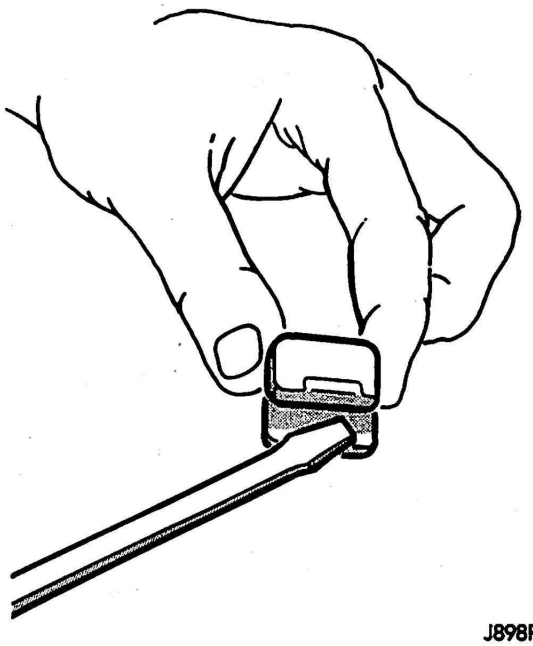
(2) Relieve tension on the tabs (Fig. 4) and remove the printed circuit board.

(3) Inspect the circuit board (Fig. 5) for the code number.



J898P-17

Fig. 2—Transmitter Battery Replacement



J898P-18

Fig. 3—Separate Transmitter Halves

RECEIVER

The receiver is located in the overhead console (Fig. 6).

Removal

(1) Pry off clear plastic lens (Fig. 7).
(2) Remove console mounting screws (Fig. 8) and lower the overhead console.
(3) Disconnect electrical connector (Fig. 9).
(4) Release tangs (Fig. 10) and remove receiver assembly (P).

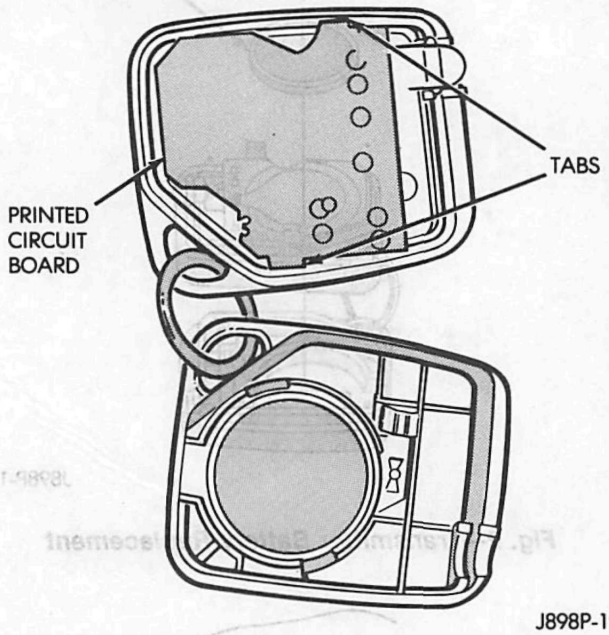


Fig. 4—Printed Circuit Board Removal

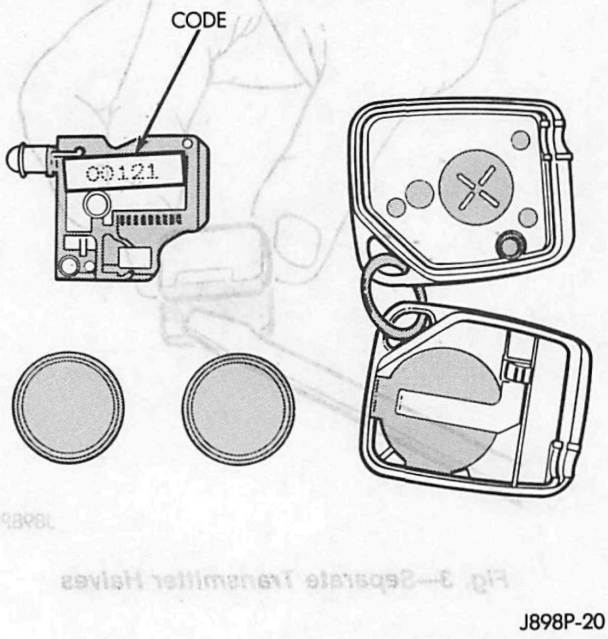


Fig. 5—Transmitter Code Number Location

(5) Inspect the printed circuit (Fig. 11) for the code number (key) for the correct replacement transmitter.

Installation

(1) Snap receiver assembly into overhead console.
(2) Connect electrical connector.
(3) Align tabs (Fig. 12), on front of overhead console, with mounting slots in roof.
(4) Swing rear of housing upward and secure console with screws.
(6) Snap clear plastic lenses in place.

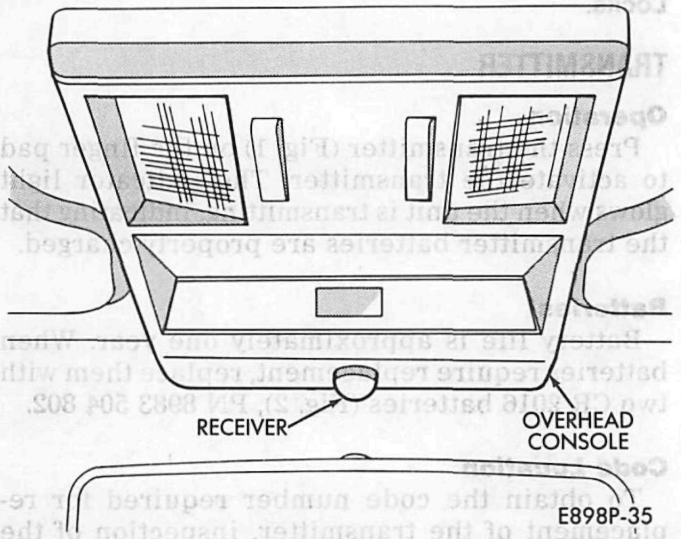


Fig. 6—Receiver Location

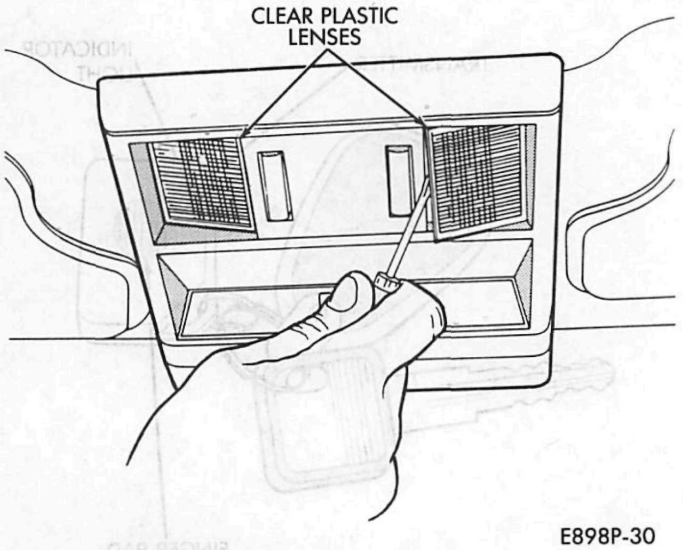


Fig. 7—Remove Clear Lens

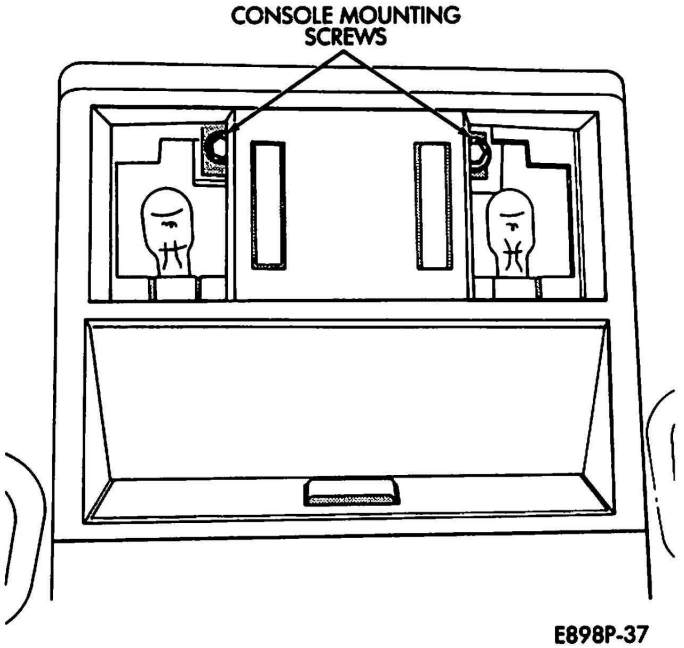


Fig. 8—Remove Overhead Console

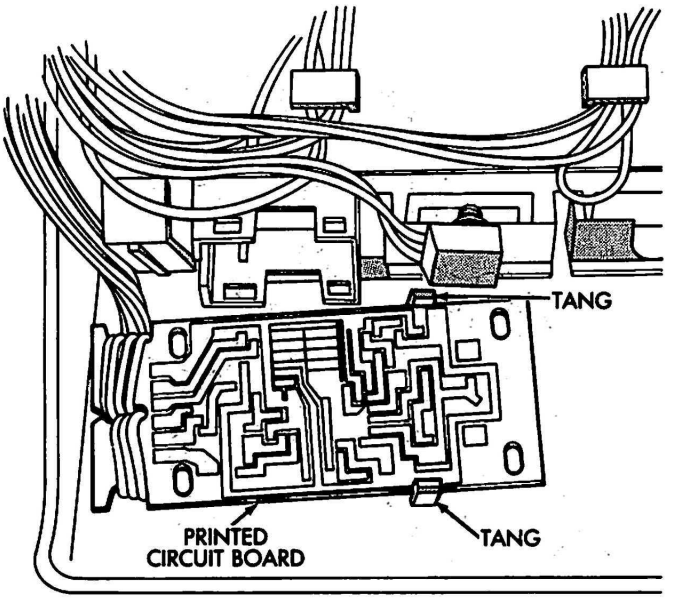


Fig. 10—Receiver Printed Circuit Board Removal

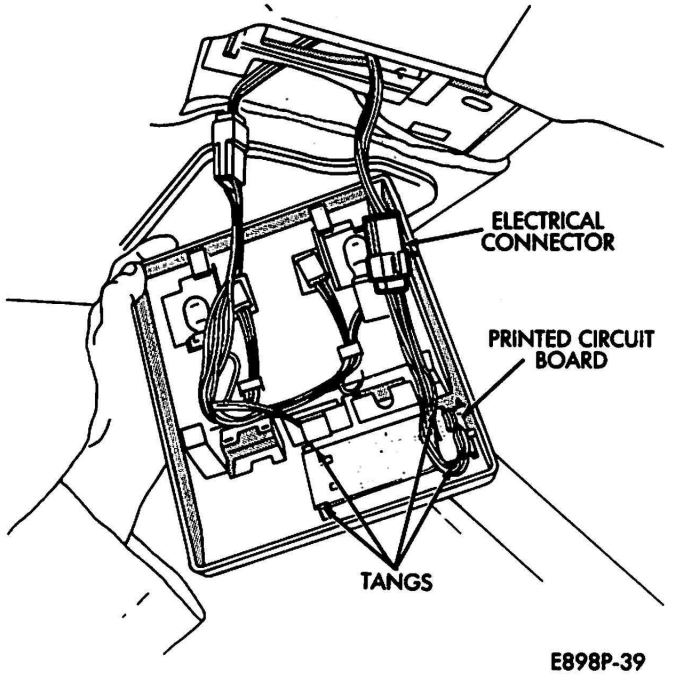


Fig. 9—Disconnect Electrical Connector

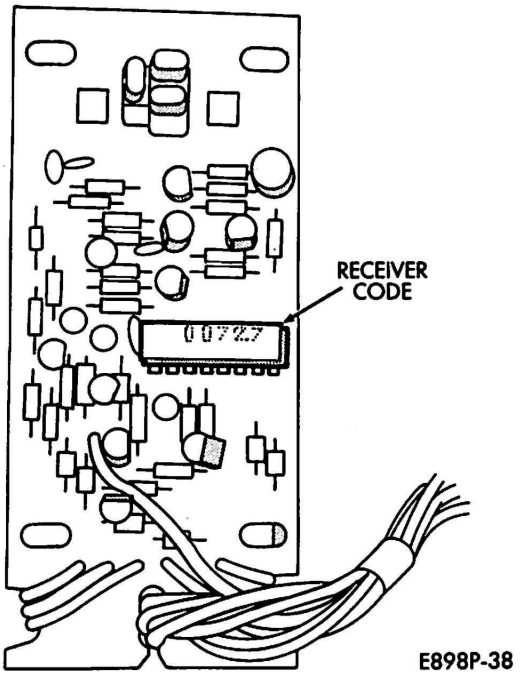


Fig. 11—Receiver Code Location

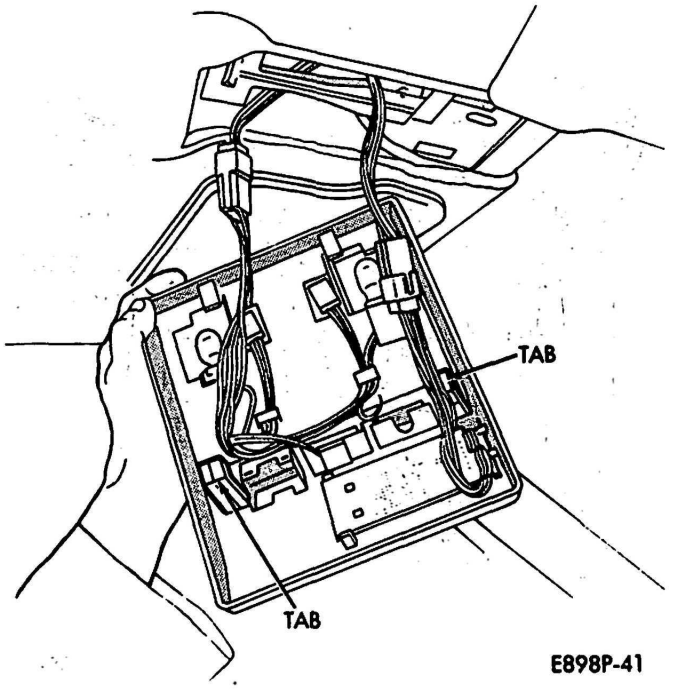


Fig. 12—Overhead Console Installation

POWER TRUNK

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Actuator Removal	17	Switch Installation	16
Electrical Diagnosis	15	Switch Removal	16

GENERAL INFORMATION

Battery voltage is applied at all times to the luggage compartment lock switch from fuse 17. When the luggage compartment lock switch is depressed, it provides battery voltage to the luggage compartment release solenoid which is energized and opens the luggage compartment.

ELECTRICAL DIAGNOSIS (Fig. 1)

Luggage Compartment Does Not Release: Luggage Compartment Lock Switch Depressed

TEST	OK	NOT OK
Luggage compartment lock switch - Terminal A	Battery voltage	Repair open to Fuse 17
Luggage compartment lock switch - Terminal B	Battery voltage	Replace luggage compartment lock switch
Luggage compartment release solenoid - Terminal B	Battery voltage	Repair open to luggage compartment lock switch
Luggage compartment release solenoid - Terminal A	Zero ohms. If OK, replace luggage compartment, release solenoid	Repair open to ground

Luggage Compartment Lamp Does Not Work: Luggage Compartment Open

TEST	OK	NOT OK
Luggage compartment lamp connector - Terminal A	Battery voltage	Repair open to Fuse 17
Luggage compartment lamp connector - Terminal B	Zero ohms. If OK, replace lamp assembly	Go to next step
Luggage compartment lamp switch connector - Terminal B	Zero ohms. Repair open between switch and lamp assembly	Go to next step
Luggage compartment lamp switch connector - Terminal A	Zero ohms. Replace luggage compartment lamp switch	Repair open to ground

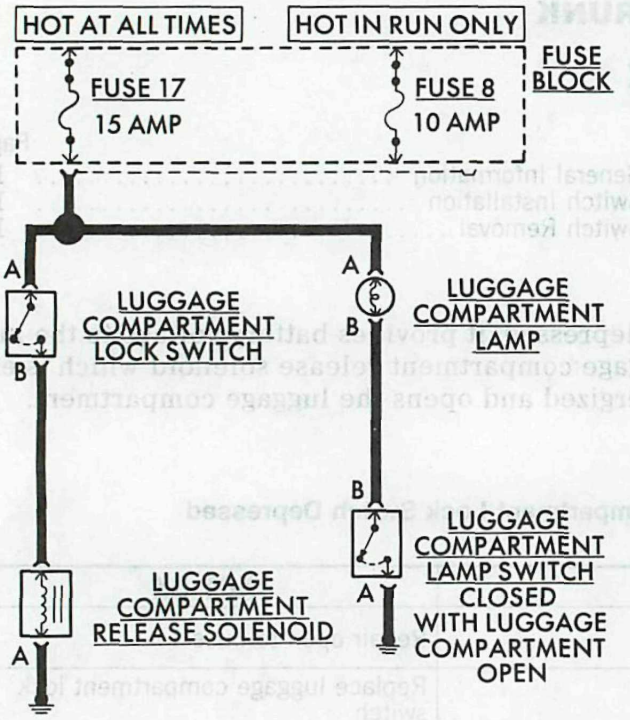


Fig. 1—Luggage Compartment Schematic

SWITCH

Removal

(1) Open glove box remove screws (Fig. 2).
(2) Remove glove box liner.

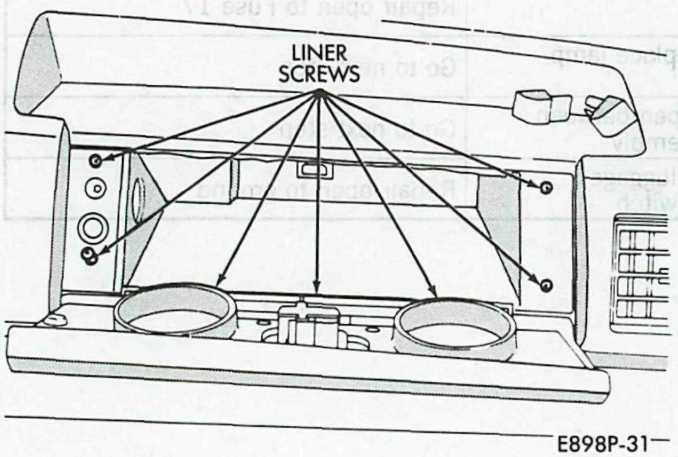


Fig. 2—Remove/Install Glove Box Liner Screws

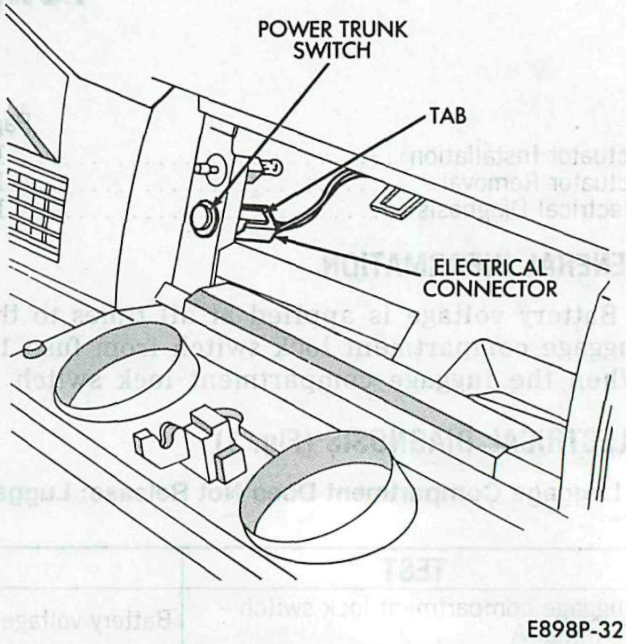


Fig. 3—Remove/Install Power Trunk Switch

(3) Lift tab (Fig. 3) on power trunk switch and disconnect connector.
(4) Remove the power trunk switch by pushing on it from inside the glove box.

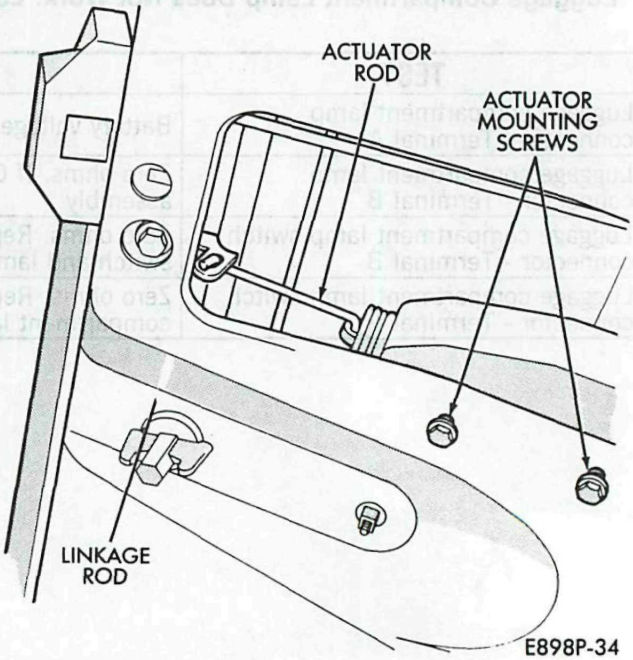


Fig. 4—Disconnect Actuator

Installation

(1) Push the power trunk switch into hole from passenger side of the glove box.
(2) Connect electrical connector.

(3) Install glove box liner and secure with screws (A).

ACTUATOR

Removal

(1) Open trunk.
(2) Remove actuator mounting screws (Fig. 4).
(3) Remove actuator rod from linkage rod.
(4) Disconnect electrical connector (Fig. 5) and remove actuator.

Installation

(1) Connect electrical connector.
(2) Position actuator in trunk by placing actuator rod Fig. 3 into hole in linkage rod.
(3) Install mounting screws.

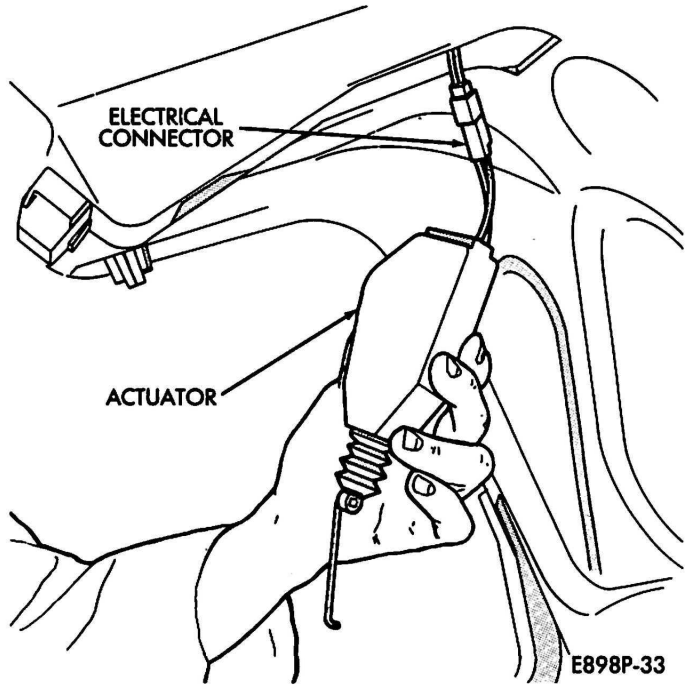


Fig. 5—Remove/Install Actuator

POWER SEATS

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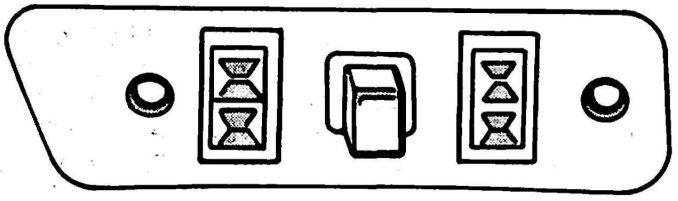
GENERAL

The power seats can be adjusted in six different directions: up, down, forward, back, tilt forward or tilt rearward.

The control switches (Fig. 1) are located on the lower outboard side of the front seats. The front lever raises or lowers (tilts) the front of the seat. The middle lever raises or lowers the complete seat by moving the lever up or down. The middle lever also moves the complete seat forward or rearward by moving the lever forward or rearward. The rear lever raises or lowers (tilts) the back of the seat.

A three armature permanent magnet reversible motor is coupled through cables to the transmission assemblies located in the seat tracks, providing the various seat movements.

The electrical circuit is protected by a 30 amp circuit breaker located under the lower instrument panel to the left of the steering column.



E898R-12

Fig. 1—Power Seat Switch

ELECTRICAL DIAGNOSIS

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DESCRIPTION

There are three reversible motors that operate each power seat. The front and the back of the seat are operated by different motors. They can be raised or lowered independently of each other.

The forward-back motor is operated by the center position seat switch. When it is held in the FORWARD position, battery voltage is applied through the switch contacts to the RED/WHT wire and the forward-back motor. The motor is grounded through the YEL/WHT wire and the contacts of the forward switch to the BLK wire and to ground. The motor runs to drive the seat forward until the switch is released.

In the BACK position, the YEL/WHT wire receives battery voltage and the RED/WHT wire is grounded. This reversed polarity causes the motor to run in the opposite direction and drive the seat backwards.

The front motor works in a similar way when the front height switch is operated. Each motor contains a self-resetting circuit breaker to protect it from overload.

DIAGNOSIS (Fig. 1)

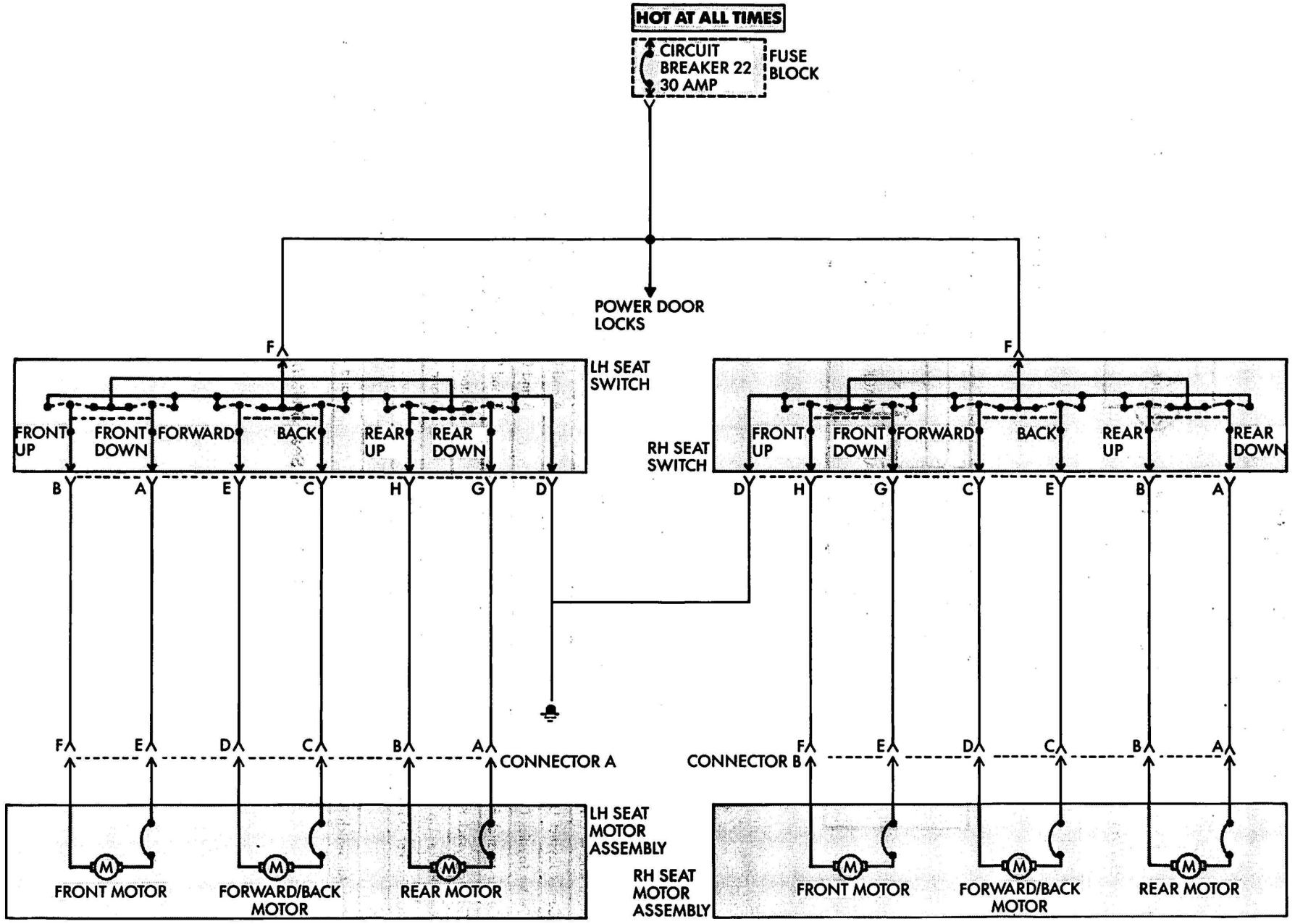
1. No Power Seat Motors Operate

TEST	OK	NOT OK
Inspect Circuit Breaker	Not blown	Replace Circuit Breaker 22
Left Hand Seat Switch connector terminal F	Battery voltage	Repair open to fuse block
Right Hand Seat Switch connector terminal F	Battery voltage	Repair open to fuse block
Left Hand Seat Switch connector terminal C	Zero ohms	Repair open to fuse ground
Right Hand Seat Switch connector terminal C	Zero ohms If OK, proceed to Switch Test	Repair open to fuse ground

2. Seat Switch Test (Figs. 2, 3)

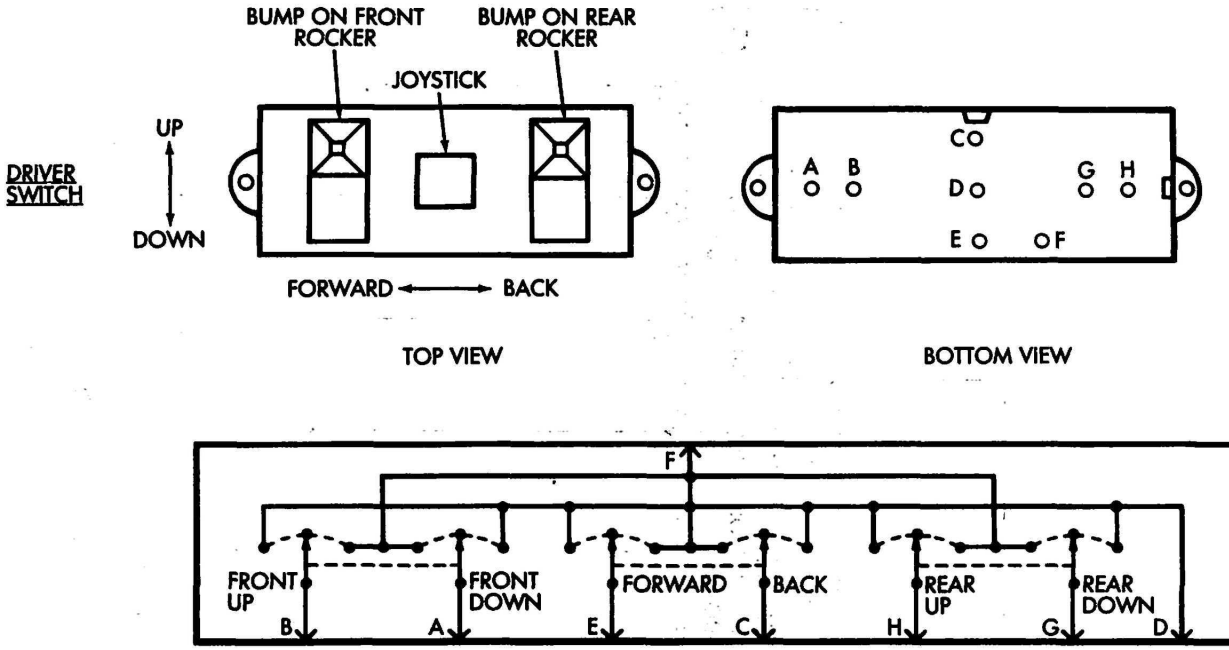
3. Seat Motor Assembly: Perform Test on Connectors A and B (Harness Side Disconnected)

TEST	OK	NOT OK
Seat Switch in REAR UP position - Terminal B	Battery voltage	Repair open to seat switch
Seat Switch in REAR DN position - Terminal A	Battery voltage	Repair open to seat switch
Seat Switch in BACK position - Terminal C	Battery voltage	Repair open to seat switch
Seat Switch in FWD position - Terminal D	Battery voltage	Repair open to seat switch
Seat Switch in FRONT UP position - Terminal F	Battery voltage	Repair open to seat switch
Seat Switch in FRONT DN position - Terminal E	Battery voltage If OK, replace seat motor assembly	Repair open to seat switch



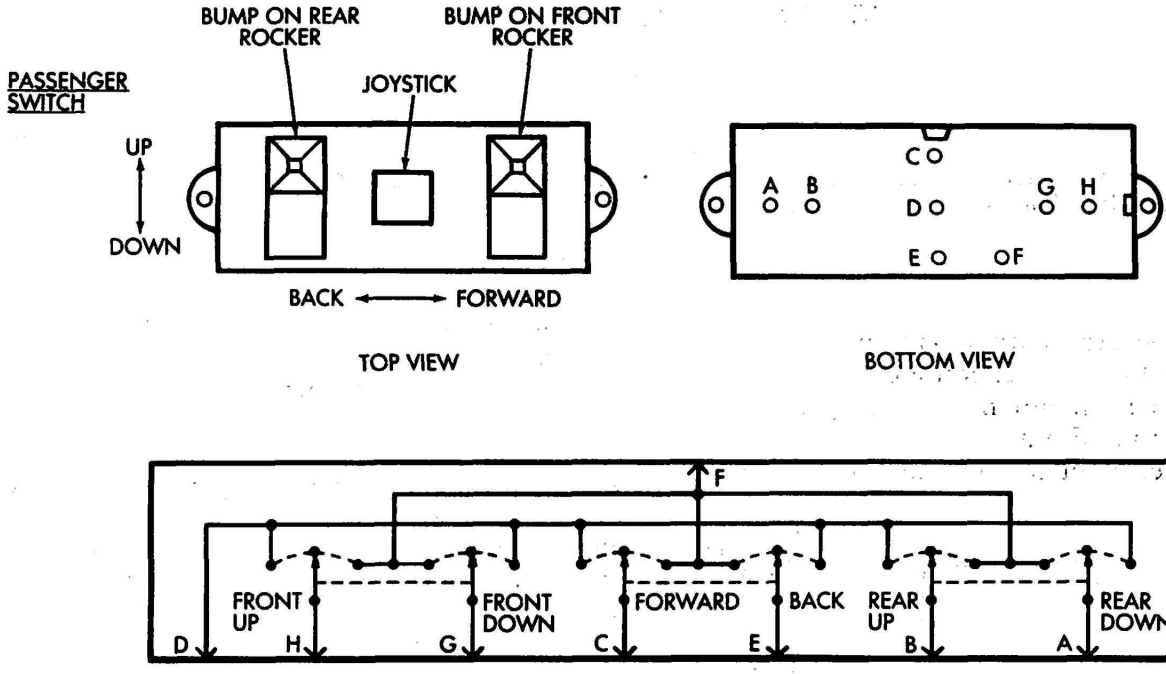
908R-24

Fig. 1—Power Seat Schematic



Switch Position	Continuity Between:
Front Rocker Up	A and D, B and F
Front Rocker Down	B and D, A and F
Center Joystick Up	A and D, D and G, B and F, F and H
Center Joystick Down	B and D, D and H, A and F, F and G
Center Joystick Forward	C and D, E and F
Center Joystick Back	D and E, C and F
Rear Rocker Up	D and G, F and H
Rear Rocker Down	D and H, F and G
Switch Position	**No Continuity (Open) Between:**
Rest, All Switch Positions	D and F E898R-23

Fig. 2—Driver Seat Switch



Switch Position	Continuity Between:
Front Rocker Up	D and G, F and H
Front Rocker Down	D and H, F and G
Center Joystick Up	A and D, D and G, B and F, H and F
Center Joystick Down	B and D, D and H, A and F, F and G
Center Joystick Forward	D and E, C and F
Center Joystick Back	D and C, E and F
Rear Rocker Up	A and D, B and F
Rear Rocker Down	B and D, A and F
Switch Position	**No Continuity (Open) Between:**
Rest, All Switch Positions	D and F E898R-24

Fig. 3—Passenger Seat Switch

SERVICE PROCEDURES

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MOTOR

Removal

(1) Remove seat track anchoring bolts (Fig. 1).
(2) Disconnect electrical connector (Fig. 1).
(3) Remove seat anchoring bolts (Fig. 2).
(4) Lift seat up and out.
(5) Disconnect electrical connector (Fig. 3).

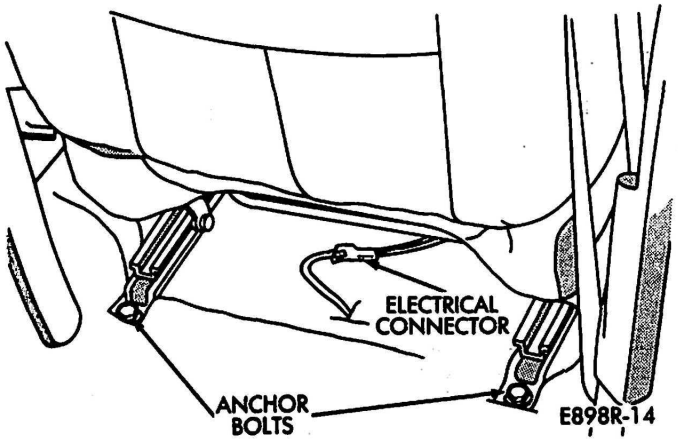


Fig. 1—Power Seat Track Anchor Bolts (Rear)

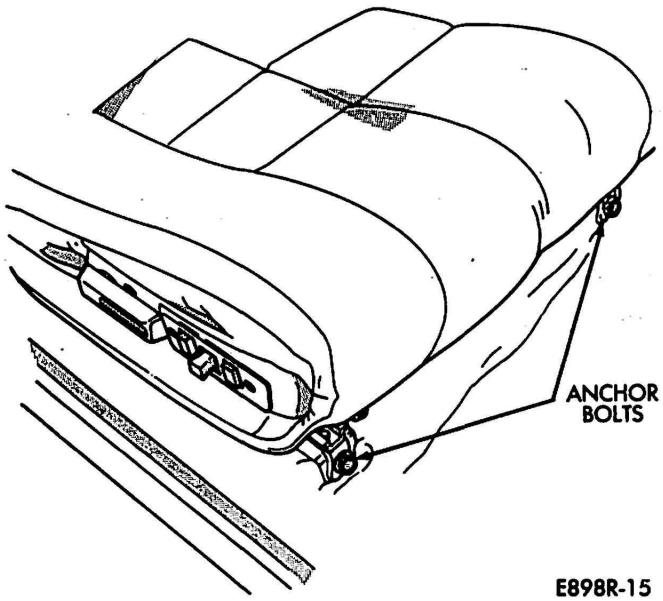


Fig. 2—Power Seat Track Anchor Bolts (Front)

(6) Remove nut.
(7) Remove screws.
(8) Pull cables out of their sockets in the motor housing.
(9) Separate motor from seat.

Installation

(1) Position motor by guiding rod through hole in motor (Fig. 4).
(2) Insert cables into the sockets in the motors.
(3) Secure motor with screws (Fig. 3).
(4) Install nut.
(5) Connect electrical connector.
(6) Position seat in vehicle.
(7) Connect electrical connector (Fig. 1).
(8) Install rear seat track anchor bolts.
(9) Install front seat track anchor bolts (Fig. 2).

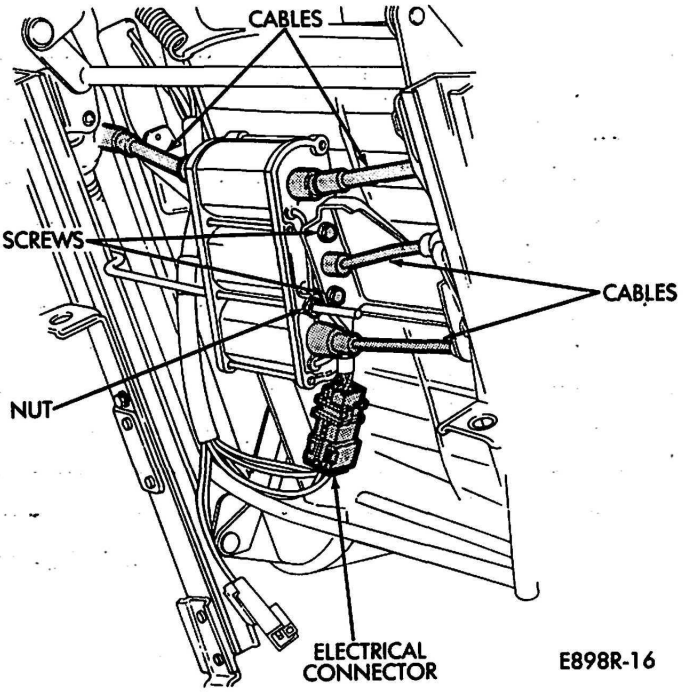


Fig. 3—Power Seat Adjuster Motor Attachment Points

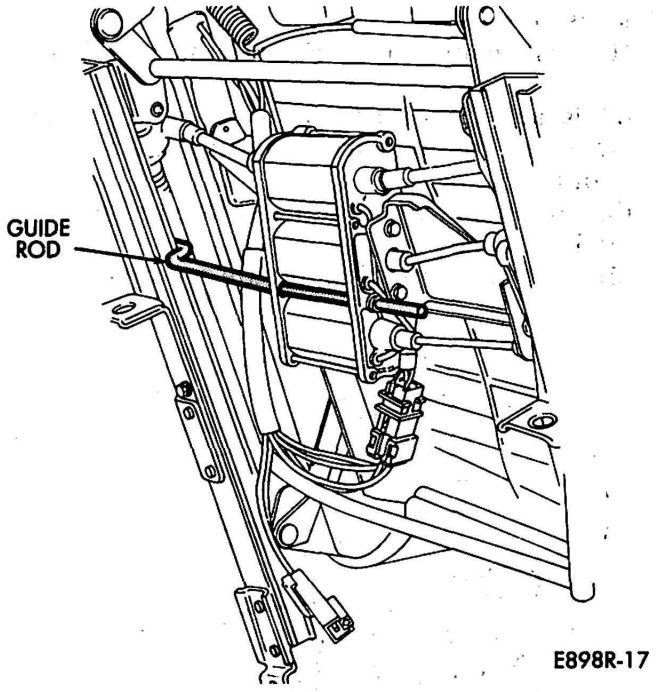


Fig. 4—Power Seat Adjuster Motor Pack Guide Rod

TRACK ASSEMBLY

Removal

(1) Remove seat as described in Motor Removal steps (1) through (4).

(2) Disconnect electrical connector (Fig. 5).

There are four studs (Fig. 5) that extend up through seat base and hold the track assembly to seat.

(3) Reach above the track assembly and remove nuts from studs.

(4) Separate track assembly from the seat.

Installation

(1) Position track assembly to seat and install nuts on studs.

(2) Connect electrical connector (Fig. 5).

(3) Place seat in vehicle.

(4) Install seat as described in Motor Installation steps (7) through (9).

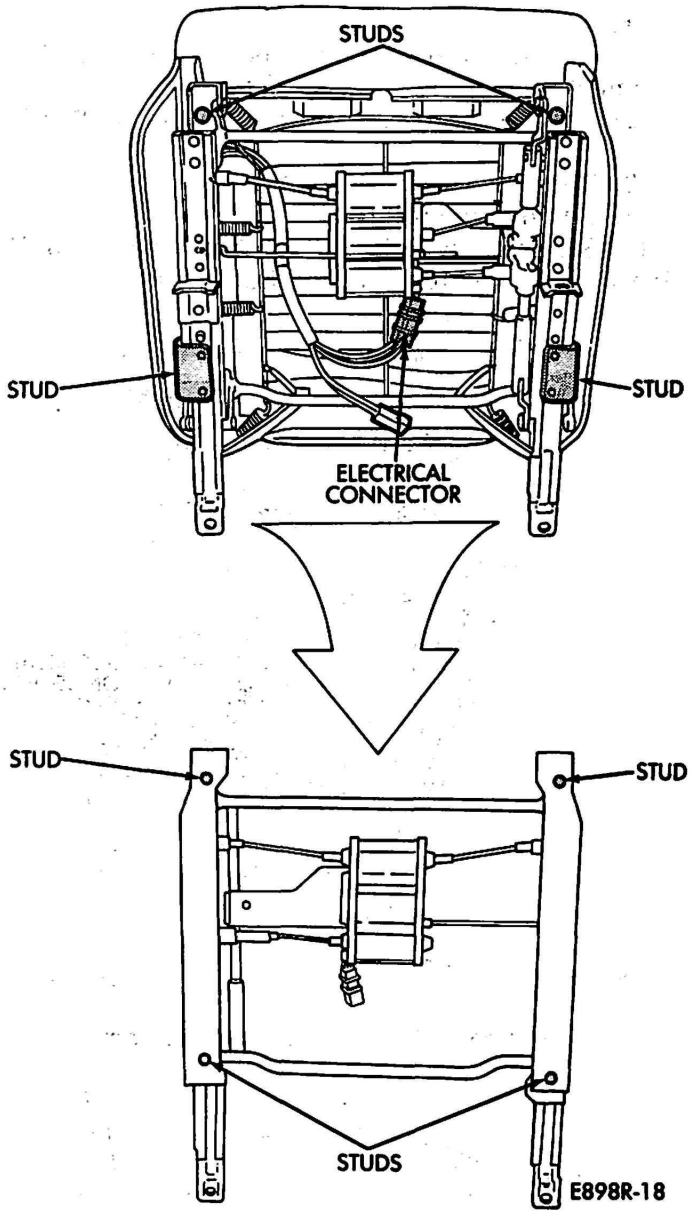


Fig. 5—Seat Frame To Adjuster Anchor Points

SWITCH

Removal

(1) Reach under seat and disconnect electrical connectors (Fig. 1).
(2) Pry the recliner handle off of its shaft (Fig. 2).
(3) Remove screws (Fig. 3).
(4) Remove faceplate.
(5) Separate switch (Fig. 4) from seat by pulling wires on switch through hole in seat.

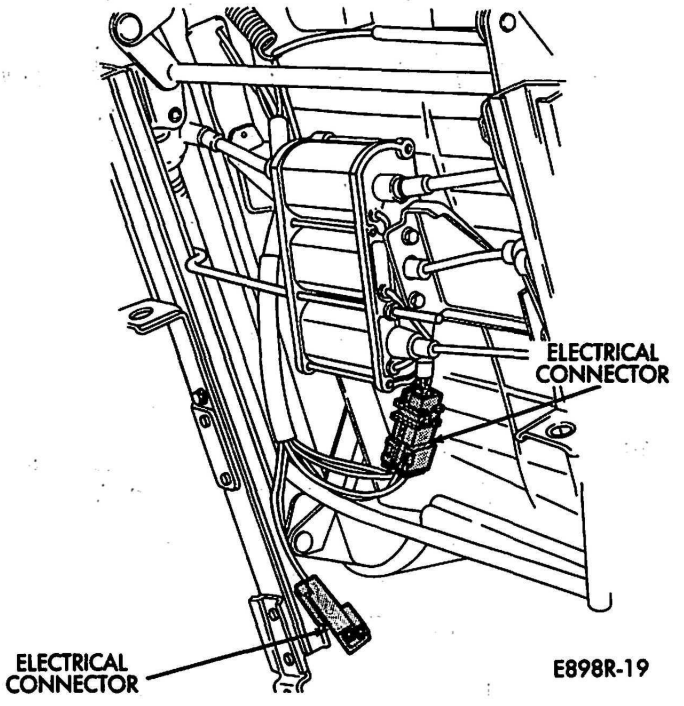


Fig. 1—Seat Adjuster Electrical Connectors

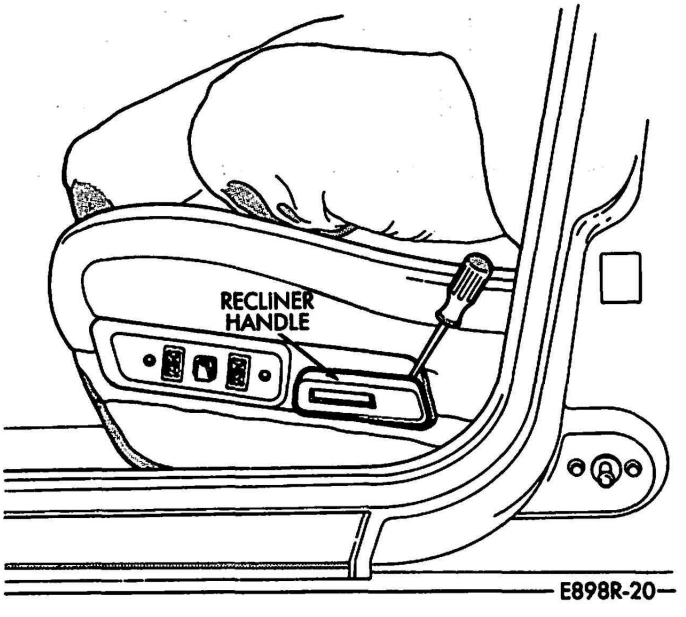


Fig. 2—Seat Outboard Faceplate and Recliner Handle

Installation

(1) Push connectors (Fig. 1) through hole in seat.
(2) Reach under seat and connect electrical connectors to the corresponding harness connectors.
(3) Position switch and faceplate on seat.
(4) Install screws (Fig. 3).
(5) Push the adjusting handle onto its shaft.

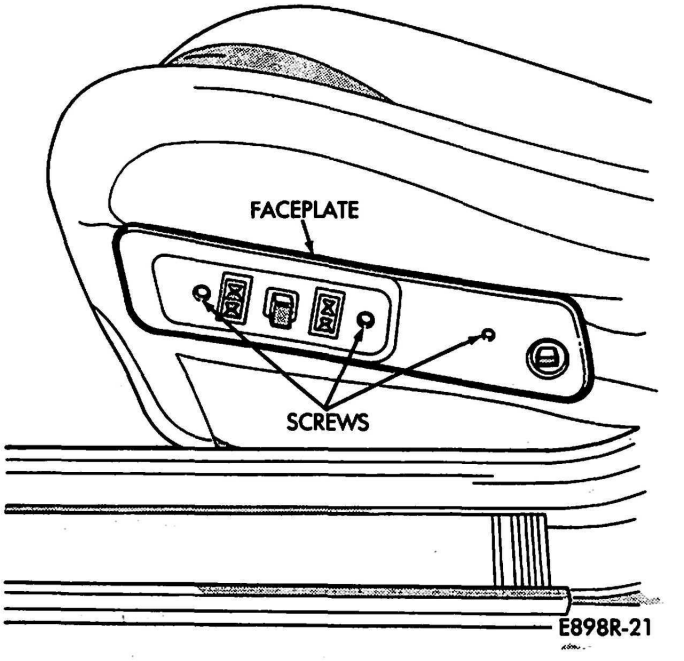


Fig. 3—Seat Faceplate

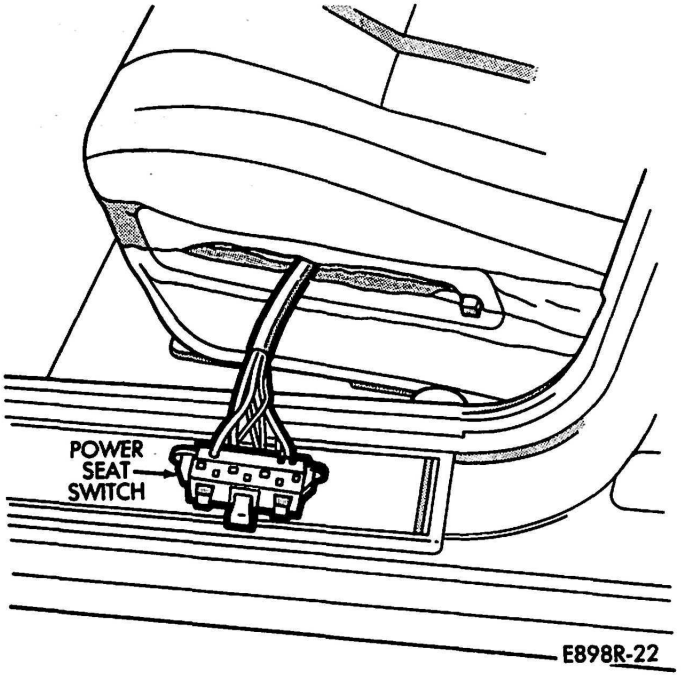


Fig. 4—Power Seat Switch

POWER WINDOWS

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ELECTRICAL DIAGNOSIS

DESCRIPTION

With the Ignition Switch in ACC or RUN, battery voltage is applied to the master door lock/power window switch assembly. The master door lock/power window switch assembly provides battery voltage and ground to the RH front window switch, and the LH front window motor. The power window switches apply battery voltage and ground to the lift motors.

All windows can be controlled by the master door lock/power window switch assembly. The passengers can also control their own windows. The master door lock/power window switch assembly contains a solid state control unit that allows the driver's window to be automatically lowered as well as a window lock switch that prevents the passenger's from operating their windows.

DIAGNOSIS (Fig. 1)

Power Windows Do Not Operate: Window Lock Switch In The UNLOCK Position

If driver's window will go up and down, but will not do so automatically, replace the master door lock/power window switch assembly.

TEST	OK	NOT OK
Connector A - Terminal E	Battery voltage	Repair open to Circuit Breaker 25
Connector A - Terminal D	Battery voltage	Replace master door lock/power window switch assembly
Connector A - Terminal F	Zero ohms	Repair open to ground
Connector B - Terminals B, D, E, F G, and H	Zero ohms	Replace master door lock/power window switch assembly
Connector B - Terminal A LH front window switch in UP position	Battery voltage	Replace master door lock/power window switch assembly
Connector B - Terminal C LH front window switch in DOWN position	Battery voltage If OK, go to next test	Replace master door lock/power window switch assembly

Passenger Window Switch: Connectors C, D, and E

TEST	OK	NOT OK
Terminal A	Zero ohms	Repair open to master door lock/power window switch assembly
Terminal B	Zero ohms	Repair open to master door lock/power window switch assembly
Terminal C	Battery voltage If OK, go to next test	Repair open to master door lock/power window switch assembly

Passenger's Window Switch: Connectors F, G, and H

TEST	OK	NOT OK
Terminal A	Zero ohms	Replace passenger's window switch
Terminal B	Zero ohms If OK, go to next test	Replace passenger's window switch

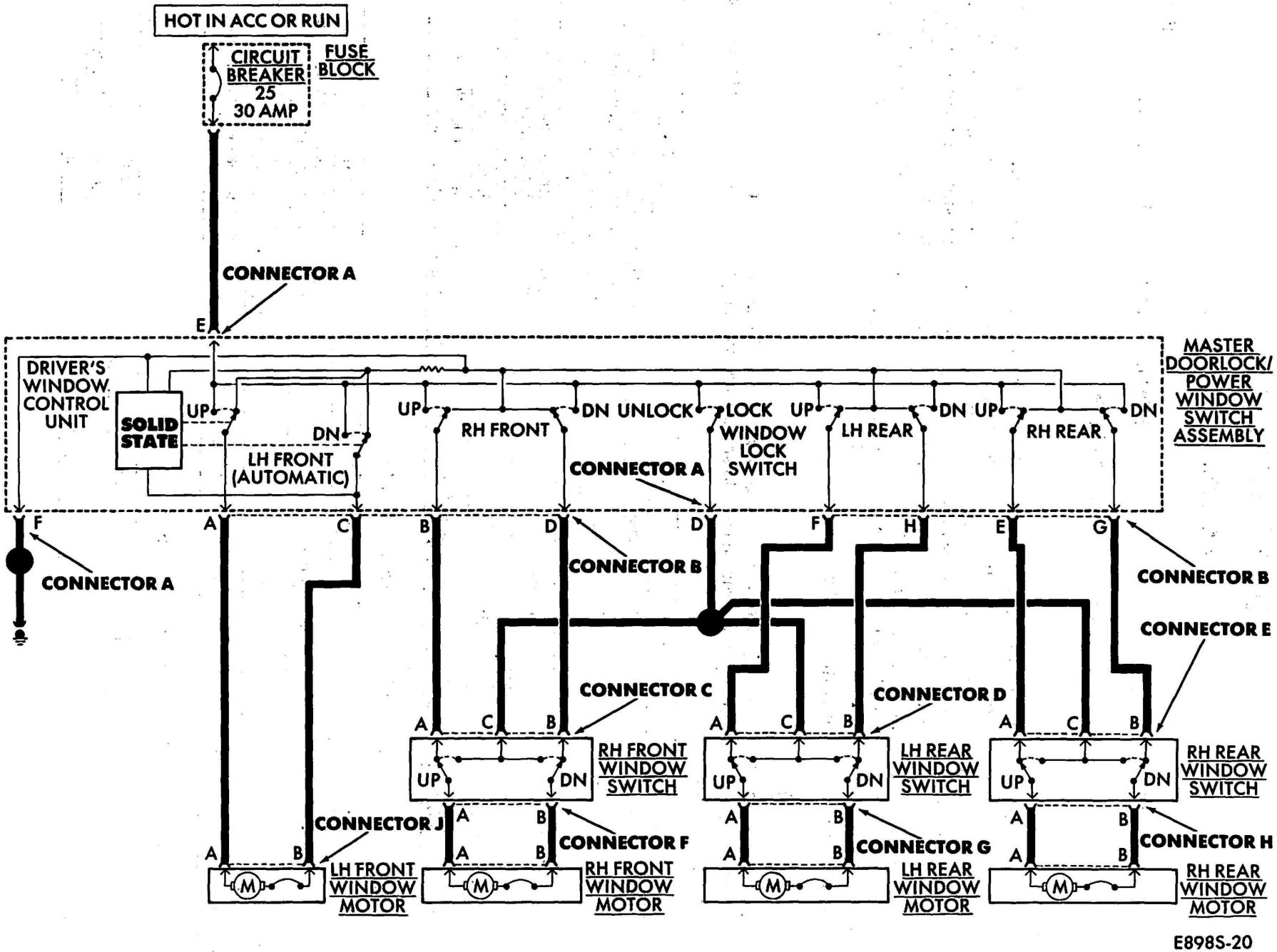


Fig. 1—Power Window Schematic

LH Front Window Motor

TEST	OK	NOT OK
Connector J - Terminal A LH front window switch in UP position	Battery voltage	Repair open to master door lock/power window switch assembly
Connector J - Terminal B LH front window switch in DOWN position	Battery voltage	Repair open to master door lock/power window switch assembly

Passenger's Window Motor

TEST	OK	NOT OK
Terminal A	Zero ohms	Repair open to window switch
Terminal B	Zero ohms If OK, replace motor	Repair open to window switch

One Power Window Does Not Operate perform Passenger's Window Switch: Connectors F, G, and H and LH Front Window Motor tests.

COMPONENT REPLACEMENT

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Rear Door Switch Removal and Installation	5

MASTER SWITCH

Removal

(1) Remove the plastic switch cover (Fig. 1) by prying up the rear of the cover. Once the rear of the cover is free, move the cover to the rear.

(2) Remove switch attaching screws (Fig. 2).

(3) Lift switch assembly up and disconnect electrical connectors (Fig. 3).

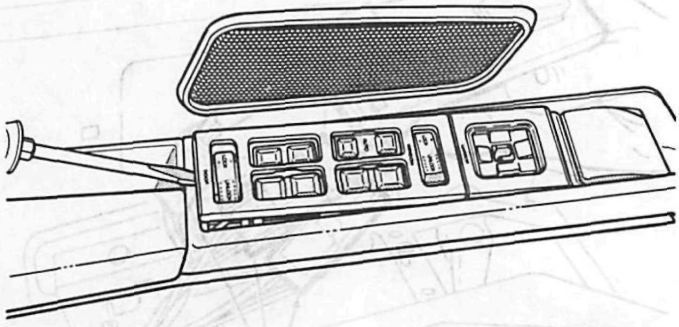


Fig. 1—Remove Switch Cover

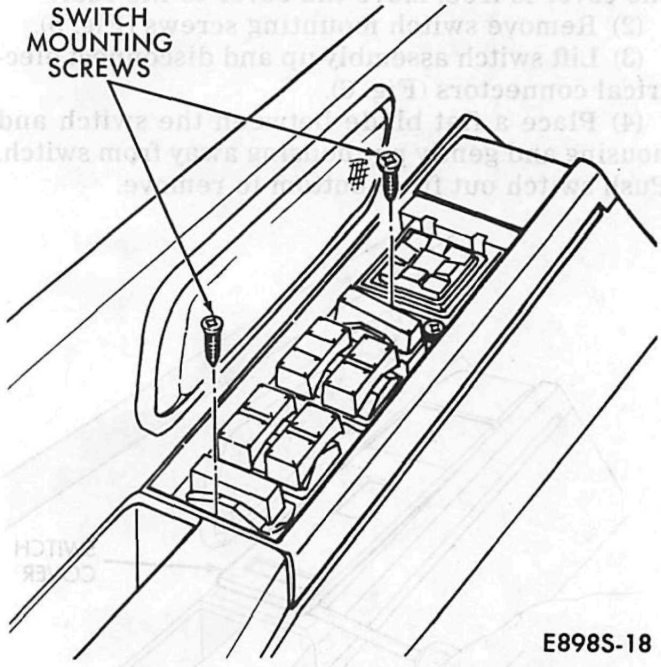


Fig. 2—Remove Switch Attaching Screws

Installation

(1) Connect electrical connector.
(2) Install switch assembly with screws.
(3) Engage tabs on front of switch cover to armrest and lower rear of cover.

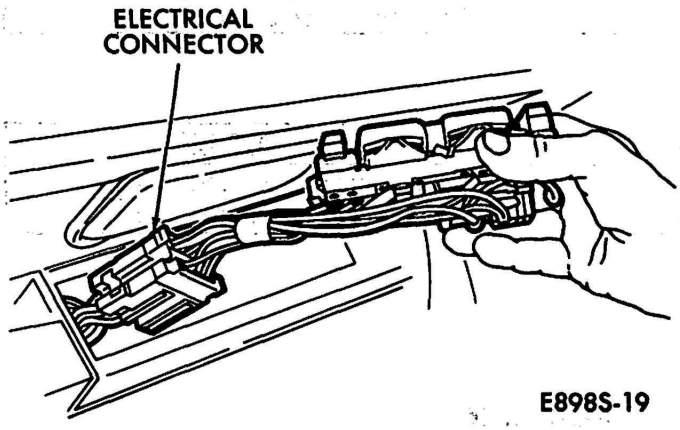


Fig. 3—Disconnect Electrical Connectors

PASSENGER DOOR SWITCH

Removal

(1) Remove the plastic switch cover (Fig. 4) by prying up the rear of the cover. Once the rear of the cover is free, move the cover to the rear.
(2) Remove switch mounting screws (Fig. 5).
(3) Lift switch assembly up and disconnect electrical connectors (Fig. 6).
(4) Place a flat blade between the switch and housing and gently pry housing away from switch. Push switch out from bottom to remove.

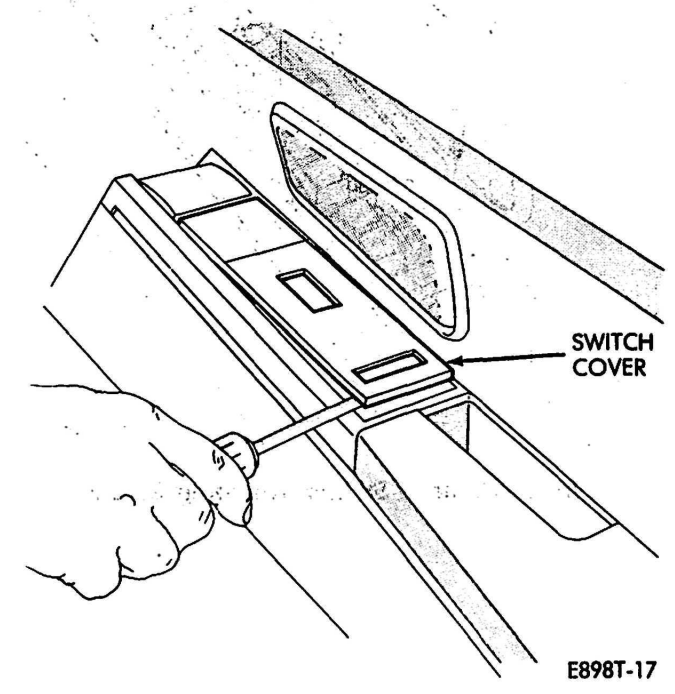


Fig. 4—Remove Switch Cover

Installation

(1) Guide switch connectors through hole in housing.
(2) Press switch assembly into housing from the top.
(3) Connect electrical connectors.
(4) Install switch assembly with screws.
(5) Engage tabs on front of switch cover to armrest and lower rear of cover.

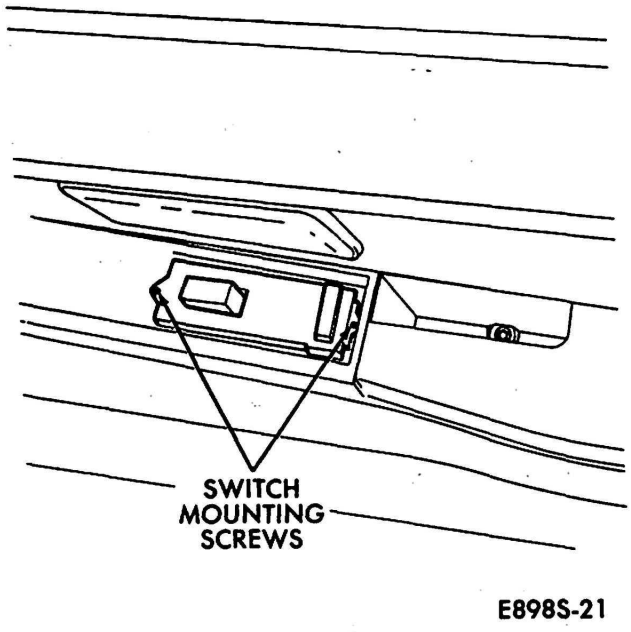


Fig. 5—Remove Switch Mounting Screws

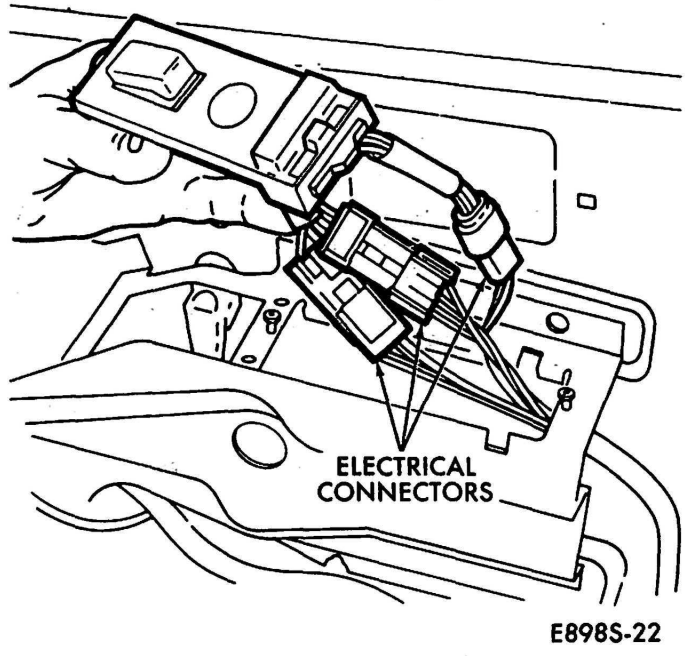


Fig. 6—Disconnect Electrical Connectors

REAR DOOR SWITCH

Removal

(1) Remove the plastic switch cover (Fig. 7) by prying up the rear of the cover. Once the rear of the cover is free, move the cover to the rear.

(2) Remove door handle/switch attaching screws (Fig. 8).

(3) Lift door handle/switch assembly and disconnect connectors (Fig. 9).

(4) Place a flat blade between the switch and housing and gently pry housing away from switch. Push switch out from bottom to remove.

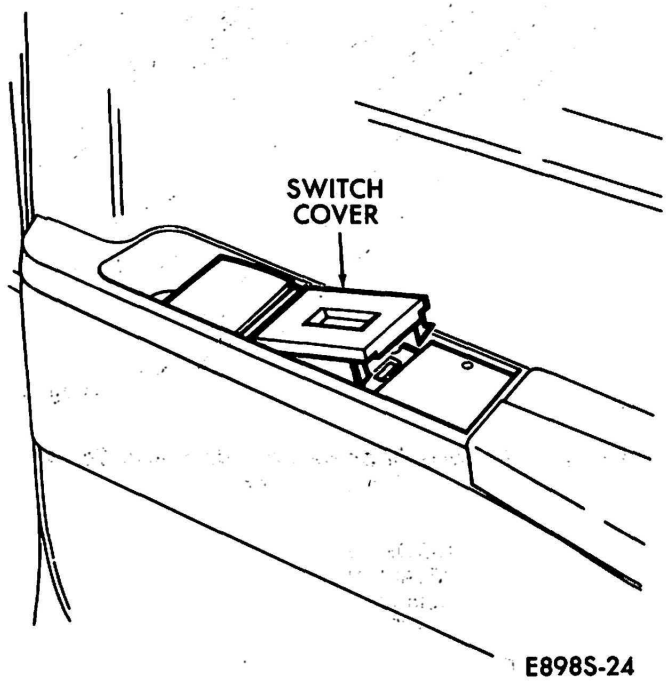


Fig. 7—Remove Switch Cover

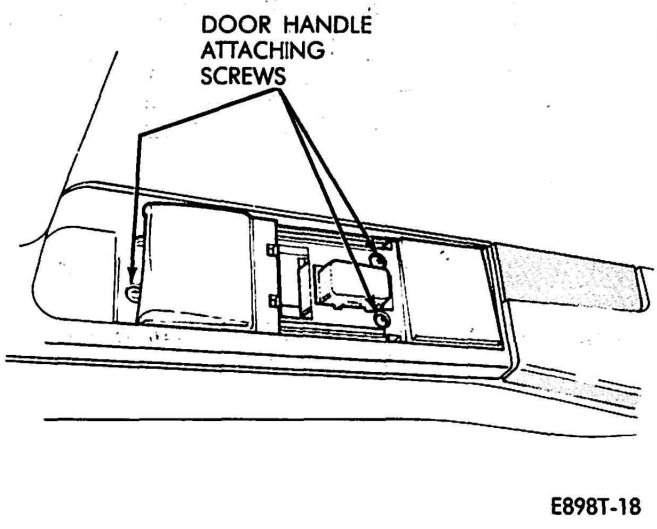


Fig. 8—Remove Switch Attaching Screws

Installation

(1) Guide connectors through opening in door handle bracket.

(2) Press switch assembly into door handle bracket from the top.

(3) Connect electrical connectors.

(4) Install door handle/switch assembly with screws.

(5) Engage tabs on front of switch cover to armrest and lower rear of cover.

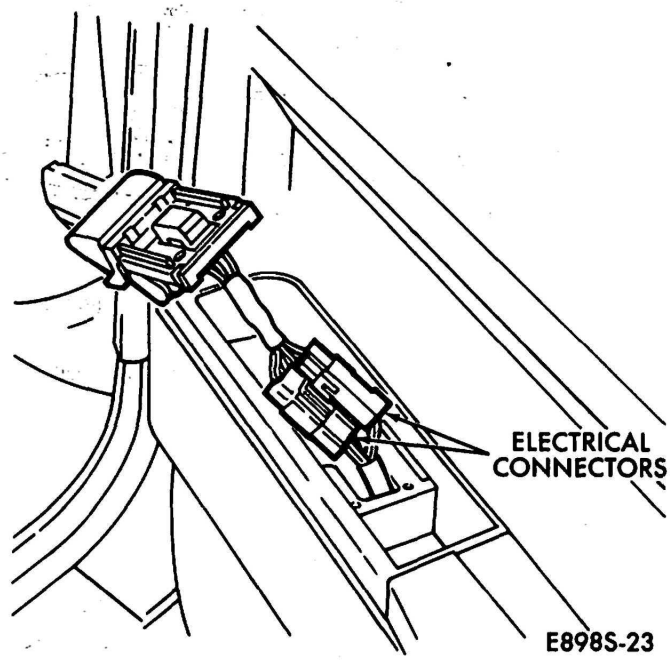


Fig. 9—Disconnect Electrical Connectors

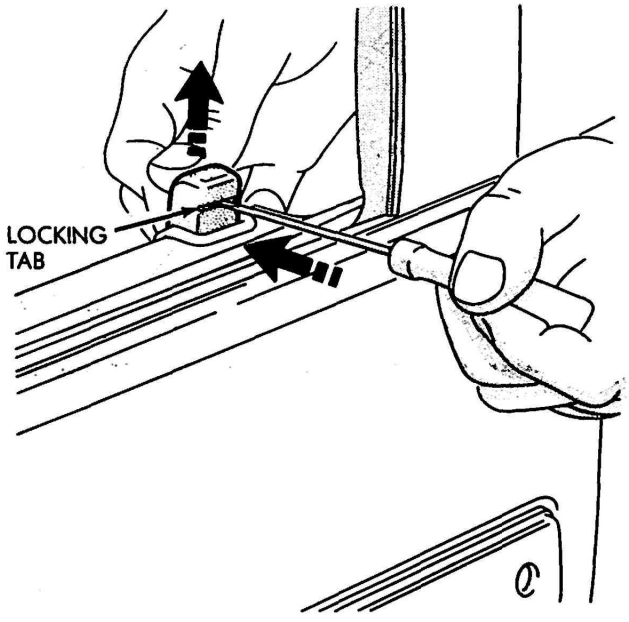


Fig. 10—Remove Lock Button

ACTUATOR/REGULATOR

Removal

(1) Remove lock button by pressing lock tab (Fig. 10) and lifting button.

(2) Remove the plastic switch cover (Figs. 11, 12) by prying up the rear of the cover. Once the rear of the cover is free, move the cover to the rear.

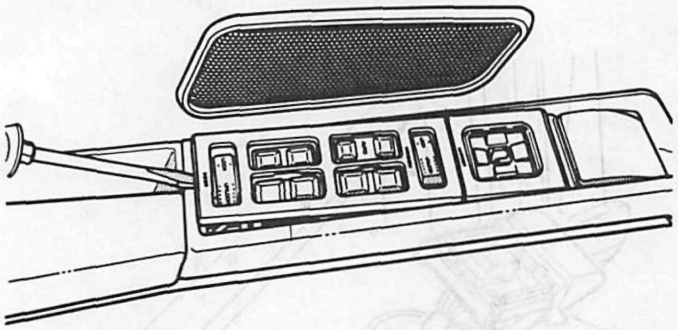


Fig. 11—Remove Switch Cover Driver's Door

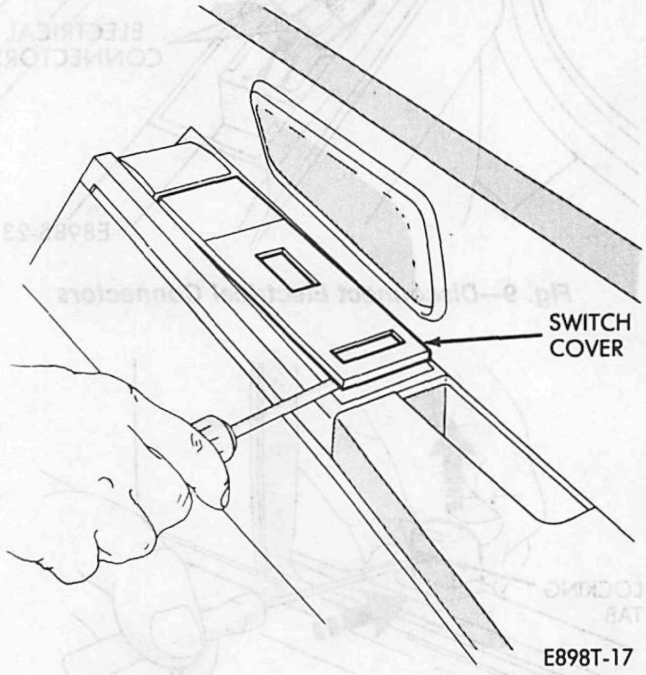


Fig. 12—Remove Switch Cover Passenger Doors

(3) Remove Door handle attaching screws (Figs. 13, 14).

(4) Lift door handle/mirror switch up and out of door.

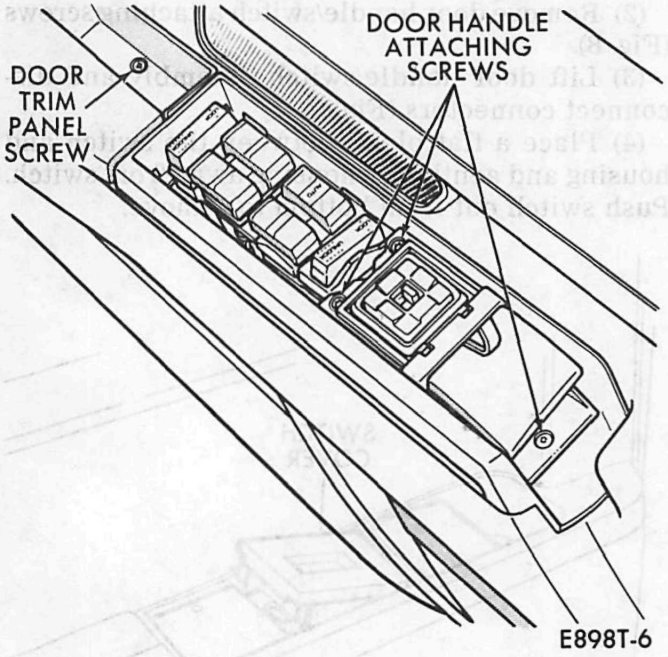


Fig. 13—Remove Door Handle Attaching Screws Driver's Door

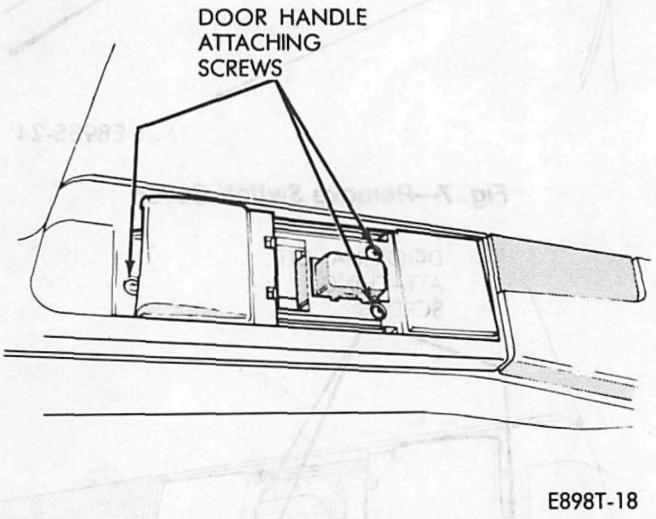


Fig. 14—Remove Door Handle Attaching Screws Passenger Doors

(5) Disconnect electrical connector (Fig. 15).
(6) Remove switch and door panel attaching screws (Figs. 13, 16, 17).
(7) Lift switch assembly up and disconnect electrical connectors (Figs. 18, 19).

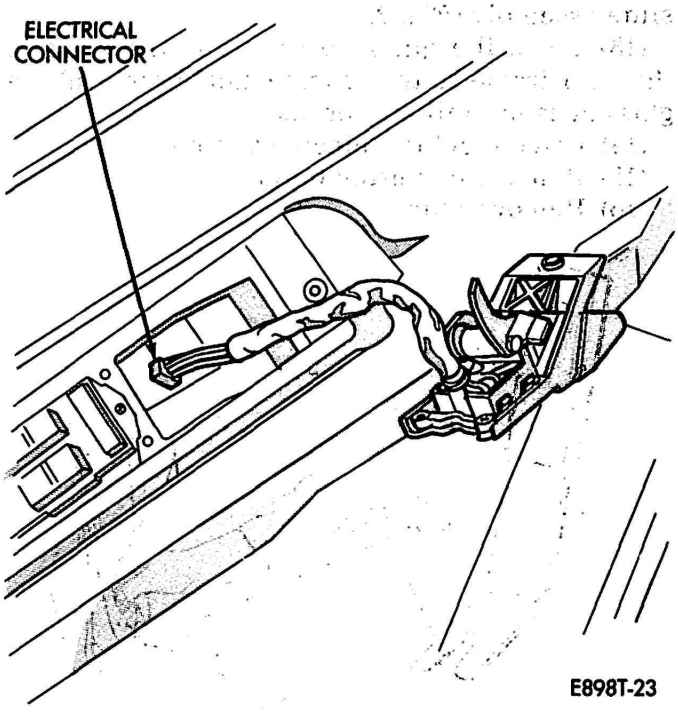


Fig. 15—Disconnect Electrical Connector

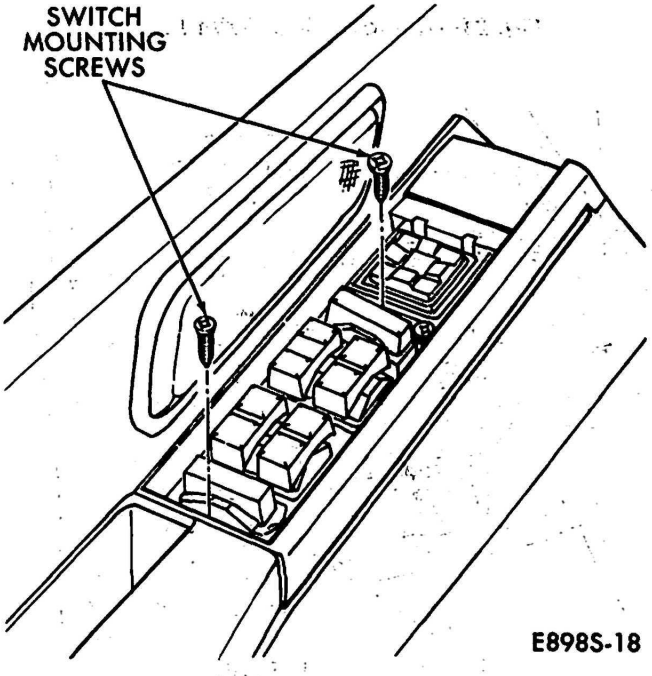


Fig. 16—Remove Switch Attaching Screws Driver's Door

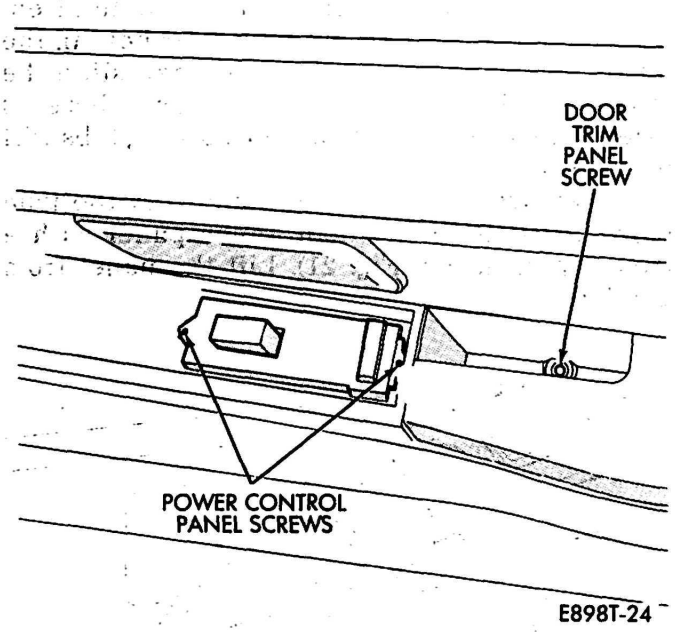


Fig. 17—Remove Switch Attaching Screws Passenger Door

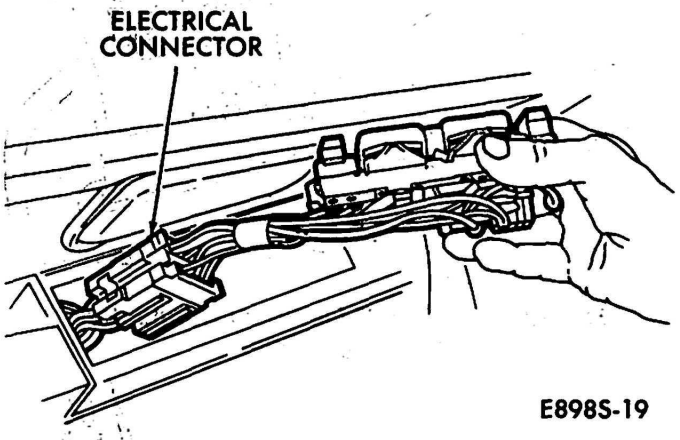


Fig. 18—Disconnect Electrical Connectors Driver's Door

(8) Pry upper corner of bezel out 1/8″ to disengage the locator tab from the locator hole in the mirror control retainer (Fig. 20), then slide the mirror bezel up to remove (if corner of bezel is pried out more than 1/8″ bezel retaining tabs will break off).

(9) Remove the door trim panel. Pry the trim panel loose from the door inner panel with a trim clip remover (Fig. 21). Lift the panel from the door.

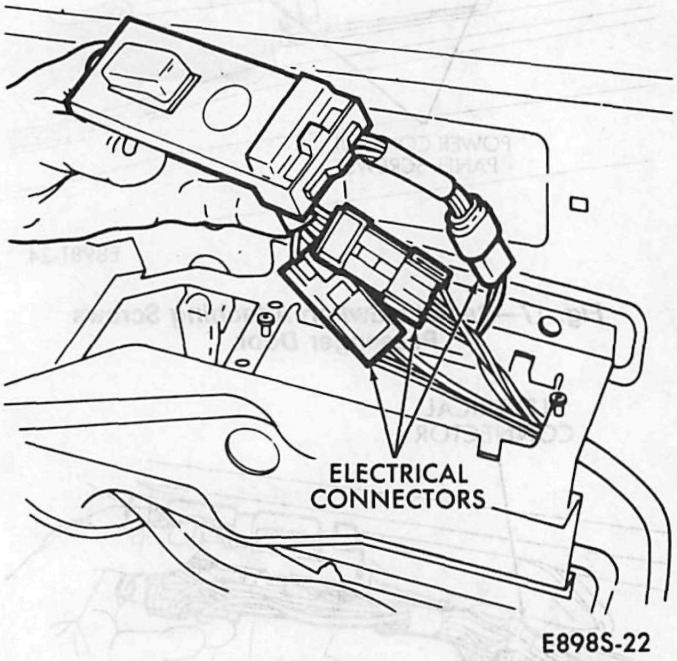


Fig. 19—Disconnect Electrical Connectors Passenger Door

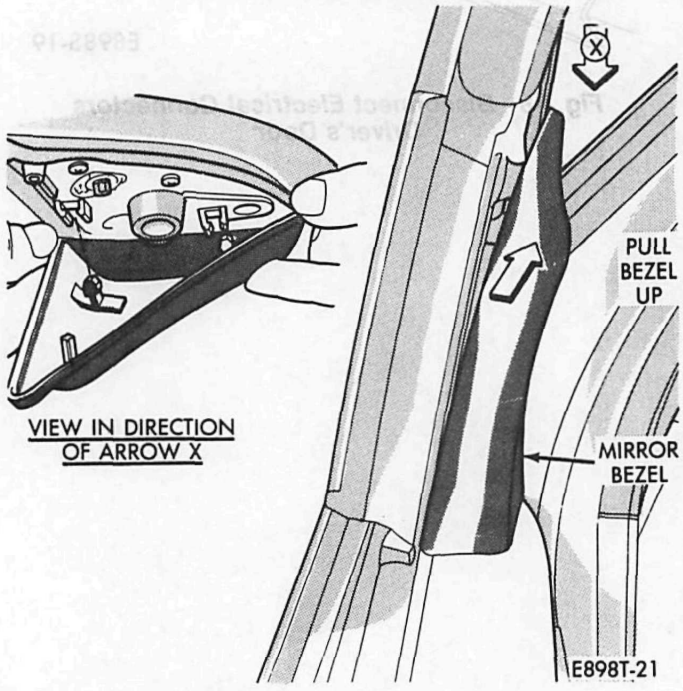


Fig. 20—Remove Mirror Bezel

(10) Remove plastic door liner (water dam) from door.

(11) Lower the glass so that the bolts are at the access holes.

(12) Remove bolts that hold the glass to the slide assembly (Fig. 22).

(13) Raise the glass up and tape the glass to the door frame so that during motor removal the glass does not fall and break.

(14) Disconnect the electrical connector.

(15) Remove mounting bolts.

(16) Remove nuts.

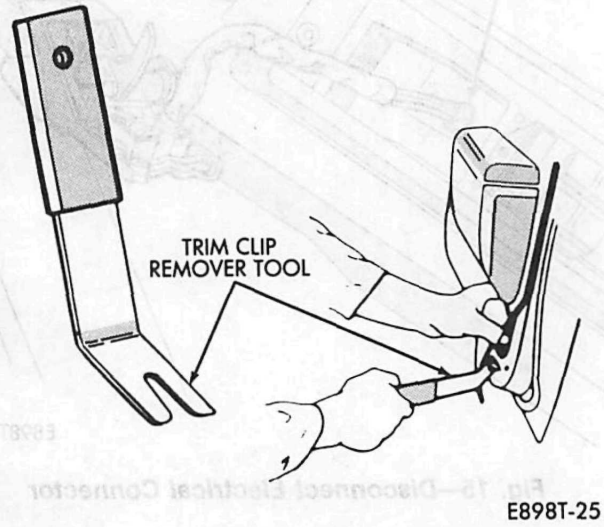


Fig. 21—Remove Door Trim Panel

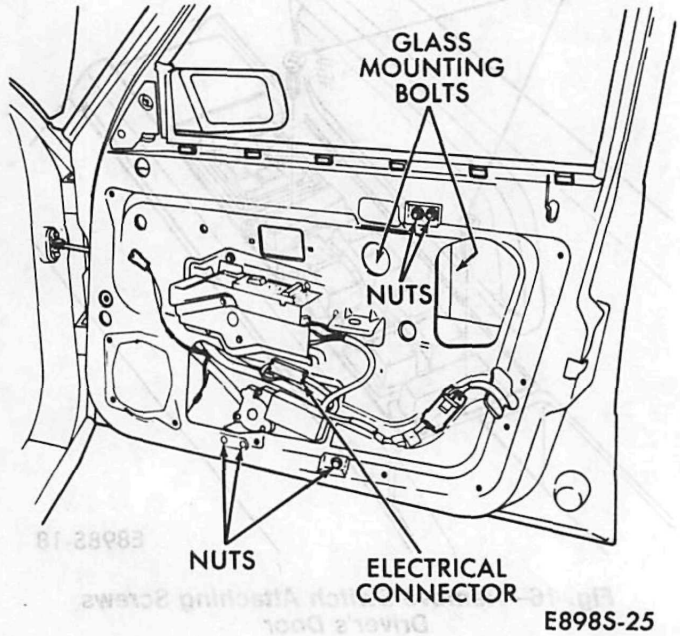


Fig. 22—Remove Actuator Mounting Hardware

(17) Guide the runout tube (Fig. 23) and actuator out of the lower opening in the door frame.

Installation

(1) Guide the actuator and runout tube into the lower opening in door frame.

(2) Install mounting bolts (Fig. 22).

(3) Install nuts.

(4) Install glass mounting bolts (finger tight only) to hold the glass to the slide assembly.

(5) Connect electrical connector.

(6) Raise glass to full up position and pull glass rearward into weatherstrip at the back of door. Tighten front glass mounting bolt, lower glass and tighten the rear mounting bolt.

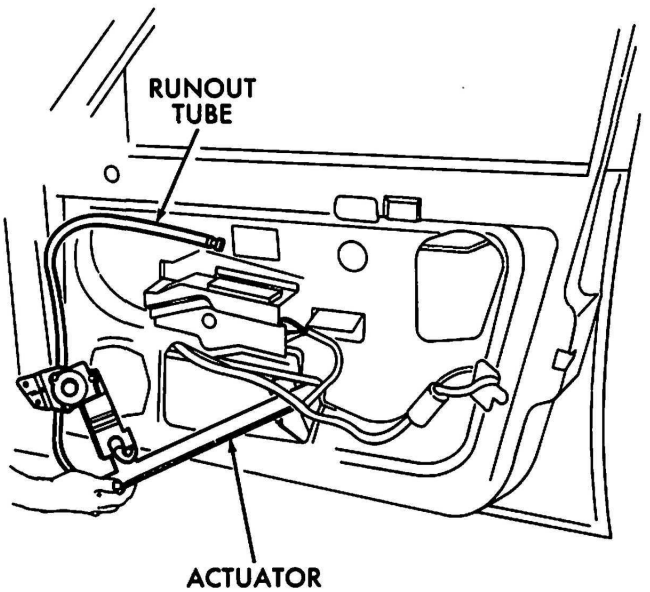


Fig. 23—Actuator Removal/Installation

(7) Install the plastic inner liner.

(8) Install door trim panel by engaging lip at top of panel to anchors (Fig. 24) on door and engaging plastic retaining clips on door panel to holes in door.

(9) Align mirror bezel locator tab and bezel attaching tabs into the mirror control retainer and snap bezel into place.

(10) Install door handle/switch asembly.

(11) Engage tabs on front of switch cover to armrest and lower rear of cover.

(12) Install lock button.

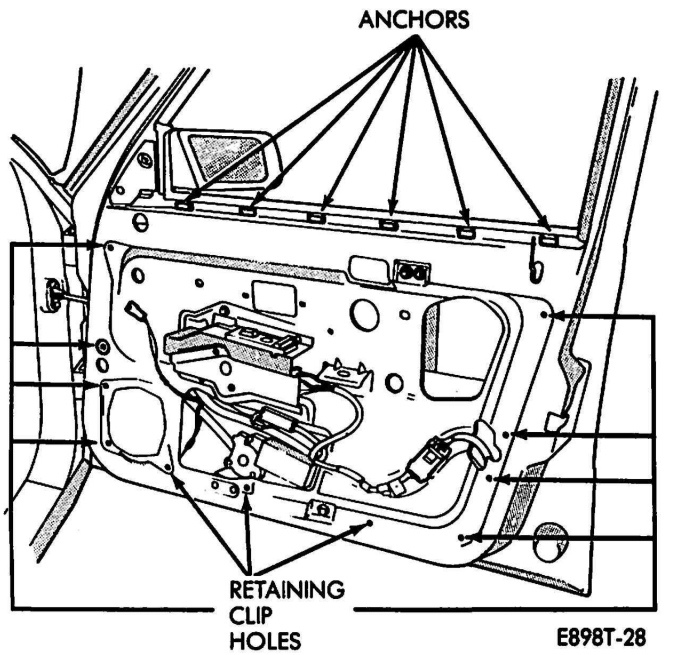


Fig. 24—Install Door Trim Panel

POWER MIRRORS

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ELECTRICAL DIAGNOSIS	1		

GENERAL INFORMATION

Electric remote control mirrors are available on Premier models equipped with power windows. Both mirrors are controlled by a dual function switch located on the left front door panel. The left/right control switch is used for directing current to the desired mirror. The horizontal/vertical switch directs current to the motor in the assembly which moves the mirror as desired.

A safety or overrun feature is designed into the mirror to prevent damage to the motor when the mirror is moved by hand or when running the mirror to the maximum limit. When the mirror is moved by hand or run to the maximum limit, a distinct snapping noise can be heard.

ELECTRICAL DIAGNOSIS

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Power Mirror Motor Test	3	Power Mirror Switch Test	3

Battery voltage to the power mirror switch is available at all times. The power mirror switch assembly controls the motors. The mirror select switch determines which set of motors operate (Fig. 1).

SWITCHES	DESCRIPTION
1, 2, and 3	Controls the up, down and left to right movements of the mirror by applying battery voltage and ground to the mirror.
4	When the driver selects the LH or RH mirror, switch 4 applies battery voltage or ground to move the mirror up or down.
5	When the driver selects the LH or RH mirror, switch 5 applies battery voltage or ground to move the mirror left or right.

DIAGNOSIS

Power Mirrors Do Not Operate, Power Door Locks Operate

TEST	OK	NOT OK
Power Mirror Switch connector - Terminal A to ground	Battery voltage	Repair open from fuse 19 NOTE: If power door locks operate, open is between connector A and Power Mirror Switch connector
Power Mirror Switch connector - Terminal G to ground	Zero ohms NOTE: Perform power mirror switch test	Repair open to ground

One Power Mirror Does Not Operate

If motor passes, perform power mirror test for inoperative side

TEST	OK	NOT OK
Perform power mirror motor test NOTE: Check continuity of wiring between motors and power mirror switch	Motor passes test	Replace with new mirror assembly

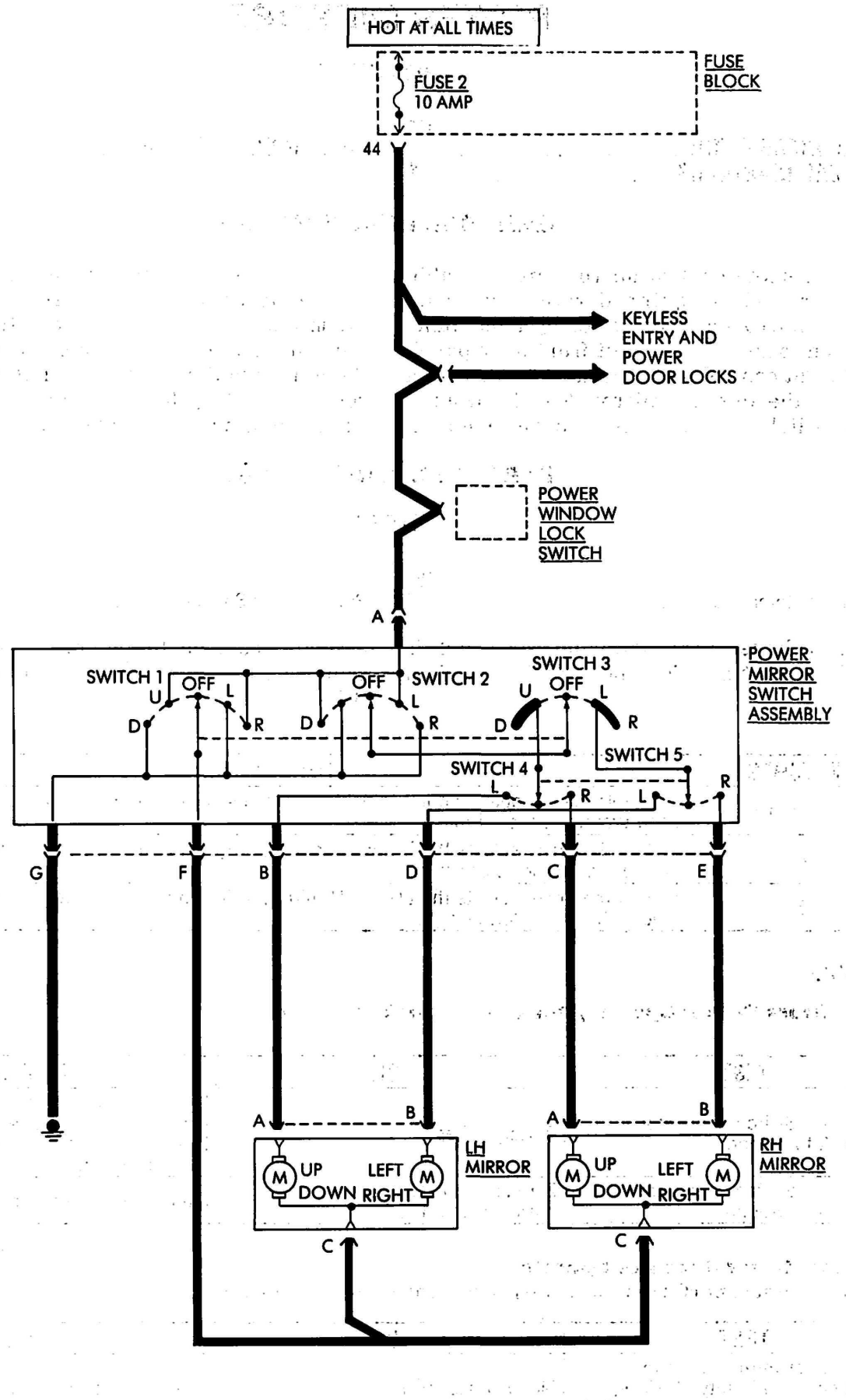
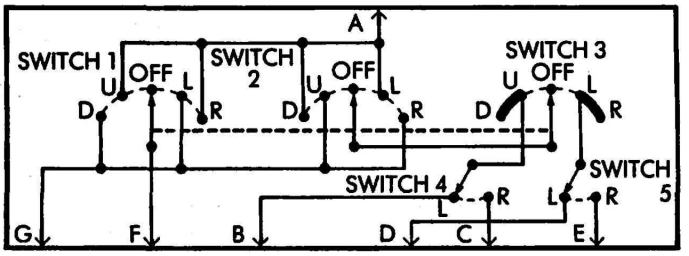


Fig. 1—Power Mirror Wiring Diagram

POWER MIRROR MOTOR TEST

Ground terminal C of LH and RH mirror connector and jumper power from terminal A of Power Mirror Switch connector to terminal B and then to terminal A of LH and RH mirror connector. Motor(s) should move and stop at the end of mirror travel. Reverse power and ground leads and motor(s) should travel in the opposite direction.



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POWER MIRROR SWITCH TEST

Power Mirror Switch Assembly: Left

SWITCH POSITION	TERMINALS	ZERO OHMS
DOWN (D)	A and B	YES
	F and G	YES
	ALL OTHERS	NO
UP (U)	A and F	YES
	B and G	YES
	ALL OTHERS	NO
OFF	ALL	NO
LEFT (L)	A and D	YES
	G and F	YES
	ALL OTHERS	NO
RIGHT (R)	A and F	YES
	D and G	YES
	ALL OTHERS	NO

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Power Mirror Switch Assembly: Right

Switch Position	Terminals	Zero Ohms
DOWN (D)	A and C	Yes
	F and G	Yes
	All Others	No
UP (U)	A and F	Yes
	G and C	Yes
	All Others	No
OFF	All	No
LEFT (L)	A and D	Yes
	F and G	Yes
	All Others	No
RIGHT (R)	A and F	Yes
	E and G	Yes
	All Others	No

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COMPONENT SERVICE

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Motor/Mirror Installation	8
Motor/Mirror Removal	4
Switch Installation	4
Switch Removal	4

SWITCH

Removal

(1) Disconnect battery negative cable.

Remove the plastic switch cover by prying up the rear of the cover (Fig. 1). Once the rear of the cover is free, move the cover to the rear.

(2) Remove screws that retain the door handle (Fig. 2).

(3) Lift door handle/mirror switch up and out of door.

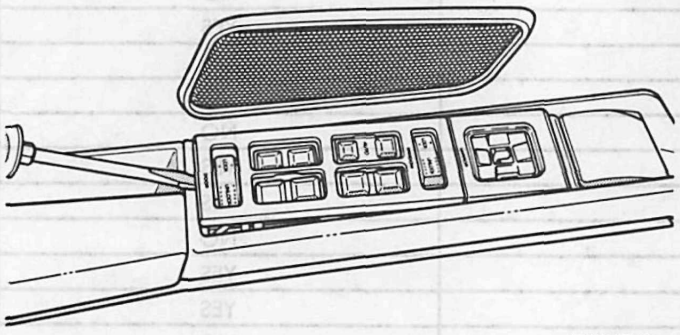


Fig. 1—Remove Switch Cover

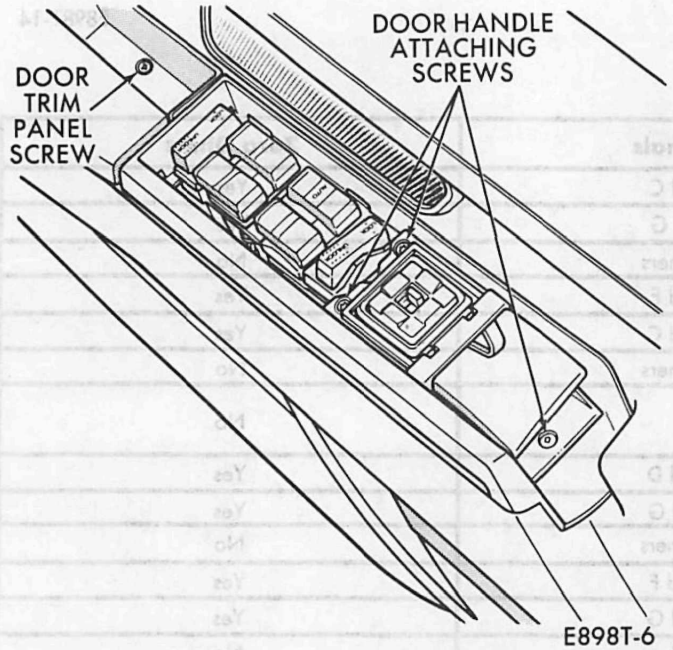


Fig. 2—Remove Door Handle Retaining Screws

(4) Disconnect electrical connector (Fig. 3).

(5) Depress locking tabs (Fig. 3) to allow the switch to separate from the handle.

(6) With locking tabs depressed, push from underneath the switch to remove it.

Installation

(1) Guide connector end of switch through mounting hole in door handle.

(2) Snap mirror switch into place. Be sure that the switch is oriented correctly; R/L switch faces right/left.

(3) Connect electrical connector.

(4) Position door handle and secure with retaining screws.

(5) Engage front of switch cover into door handle frame then snap rear of cover in place.

(6) Connect battery negative cable.

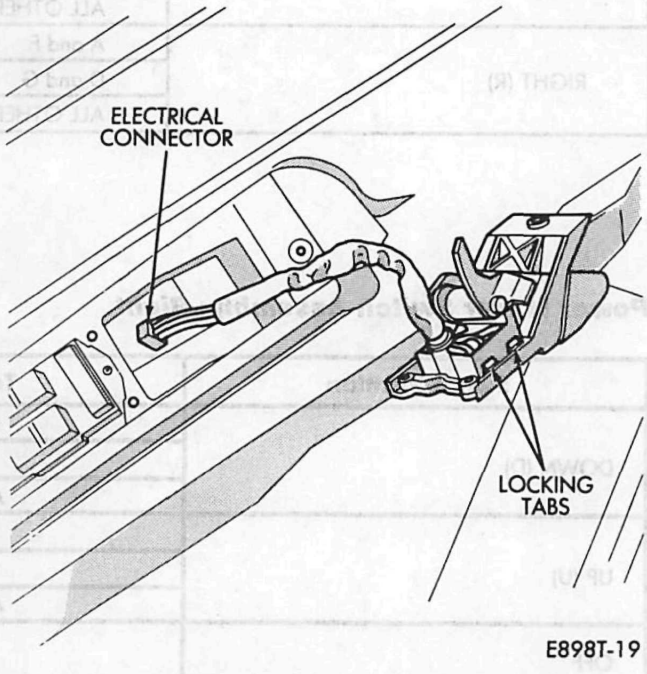


Fig. 3—Disconnect Electrical Connector and Retaining Tabs

MOTOR/MIRROR

Removal

(1) Remove lock button by pressing locking tab (Fig. 4).

(2) Remove the plastic switch cover by prying

up the rear of the cover (Figs. 5, 6). Once the rear of the cover is free, move the cover to the rear.

(3) Remove door handle attaching screws (Figs. 7, 8).

(4) If the drivers door mirror is being replaced, lift door handle/mirror switch up and out of door.

(5) Disconnect electrical connector (Fig. 9).

(6) Remove switch and door panel attaching screws (Figs. 7, 10, 11).

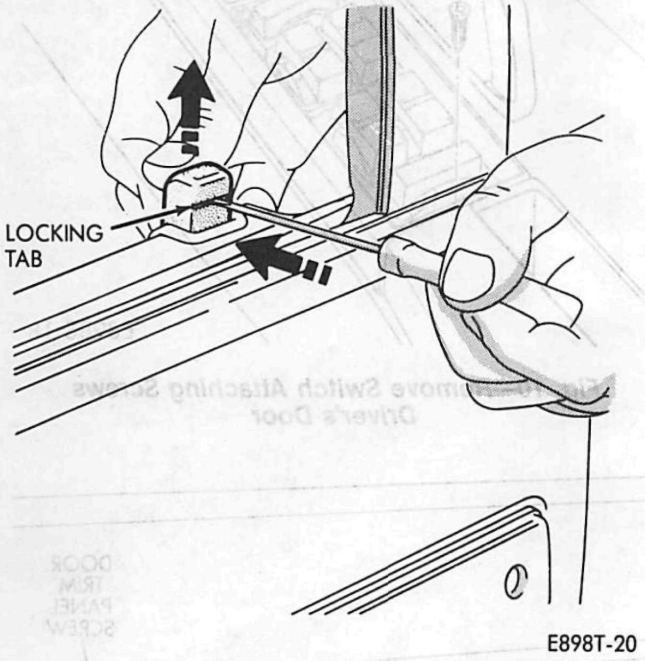


Fig. 4—Press Locking Tab

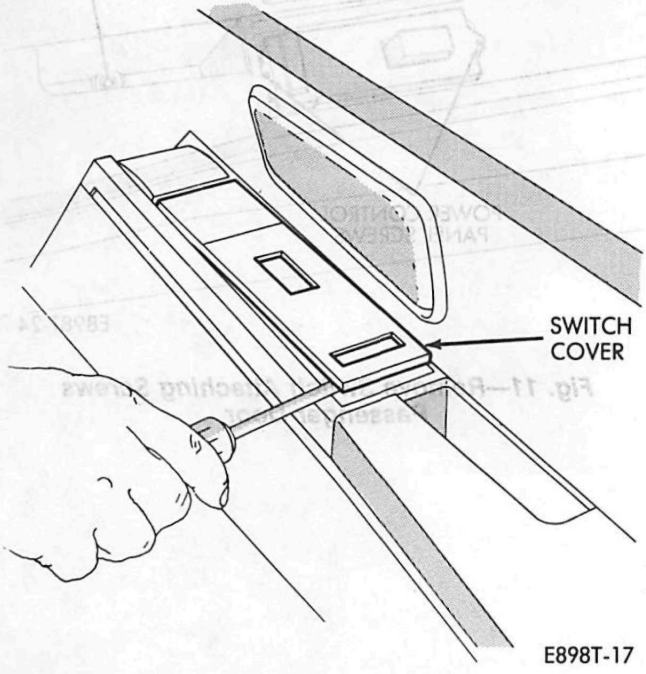


Fig. 5—Remove Switch Cover Passenger Door

(7) Pry upper corner of bezel out 1/8″ to disengage the locator tab from the locator hole in the mirror control retainer (Fig. 12), then slide the mirror bezel up to remove (if corner of bezel is pried out more than 1/8″ bezel retaining tabs will break off).

(8) Remove two screws and remove mirror retainer (Fig. 13).

(9) Remove the door trim panel. Use a Trim Clip Remover Tool (Fig. 14). Pry the trim panel loose from the door inner panel. Lift the panel from the door.

(10) Remove plastic door liner (water dam) from door.

(11) Disconnect power mirror electrical connector (Fig. 15).

(12) Remove mirror attaching nuts (Fig. 16).

(13) Remove power mirror assembly.

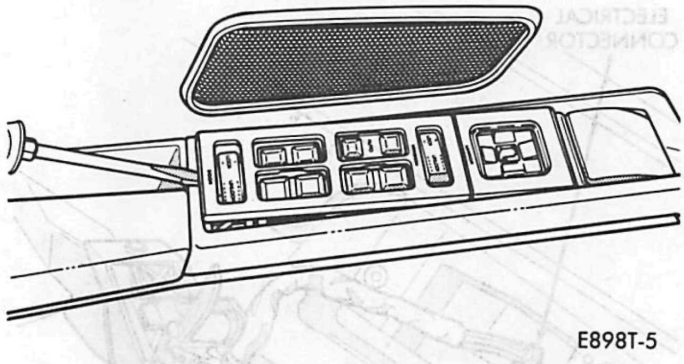


Fig. 6—Remove Switch Cover Driver's Door

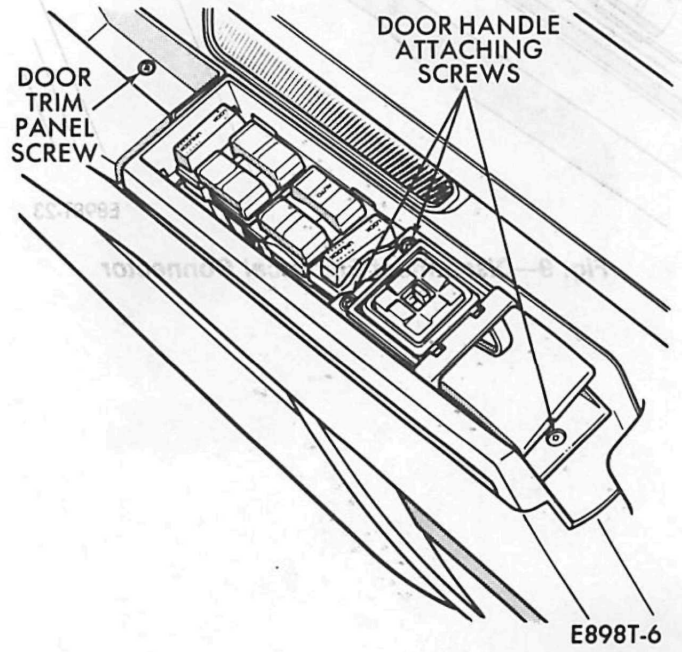


Fig. 7—Remove Door Handle Attaching Screws Driver's Door

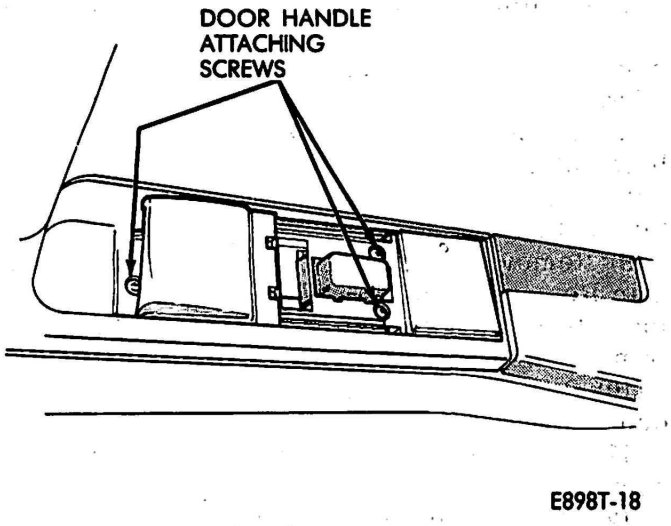


Fig. 8—Remove Door Handle Attaching Screws Passenger Doors

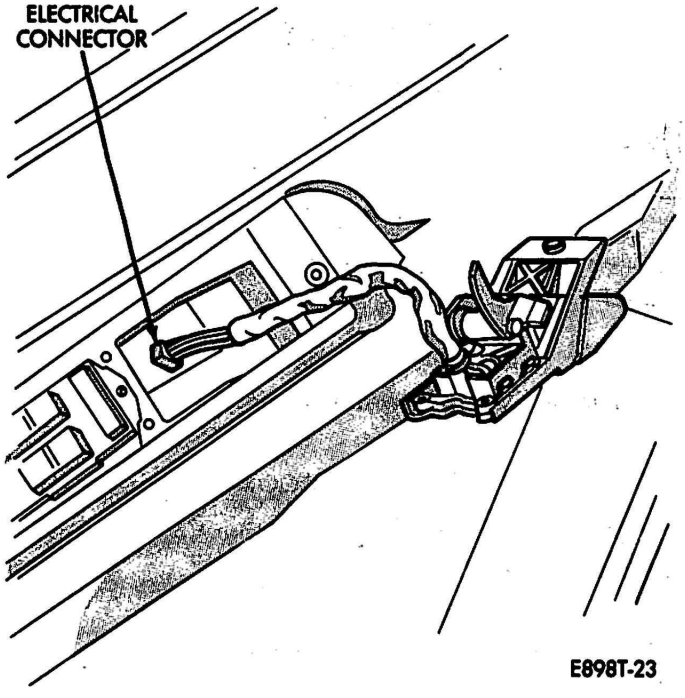


Fig. 9—Disconnect Electrical Connector

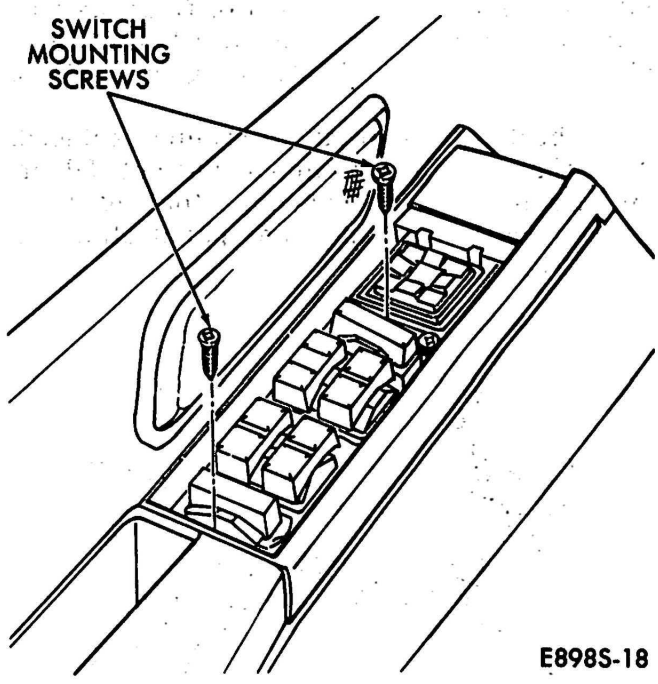


Fig. 10—Remove Switch Attaching Screws Driver's Door

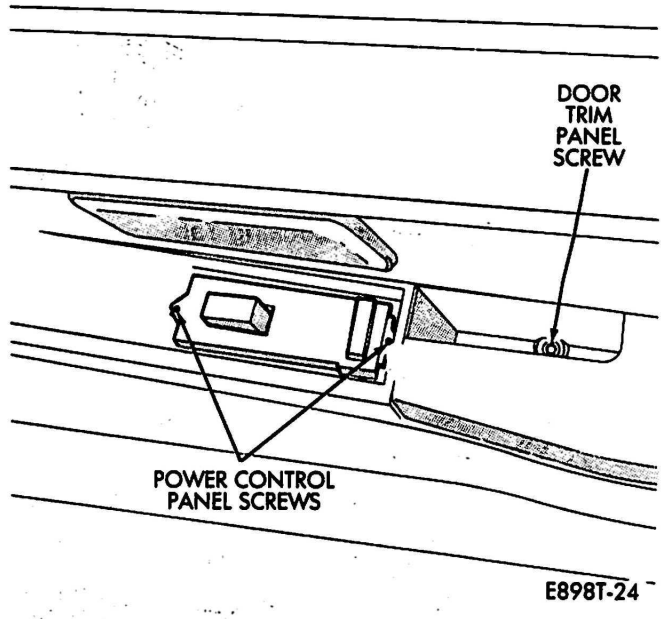


Fig. 11—Remove Switch Attaching Screws Passenger Door

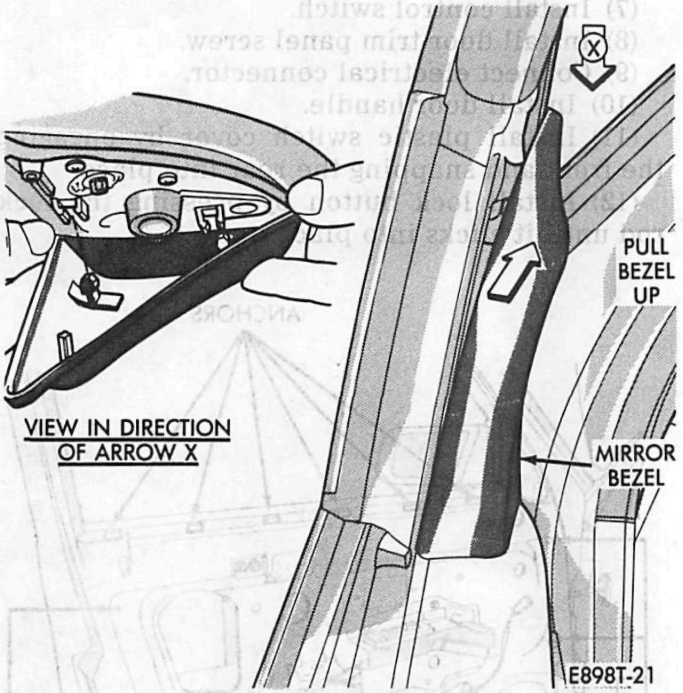


Fig. 12—Remove Mirror Bezel

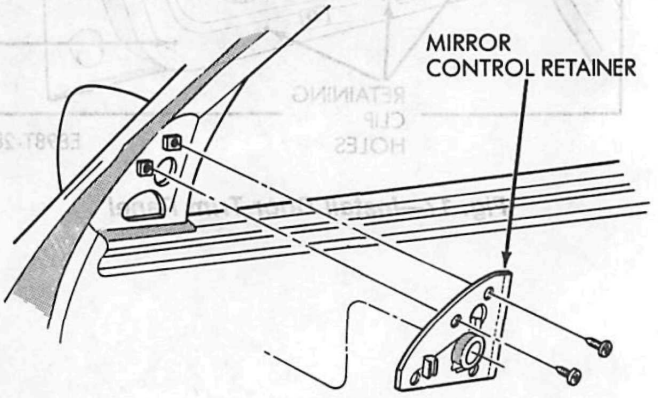


Fig. 13—Remove Mirror Retainer

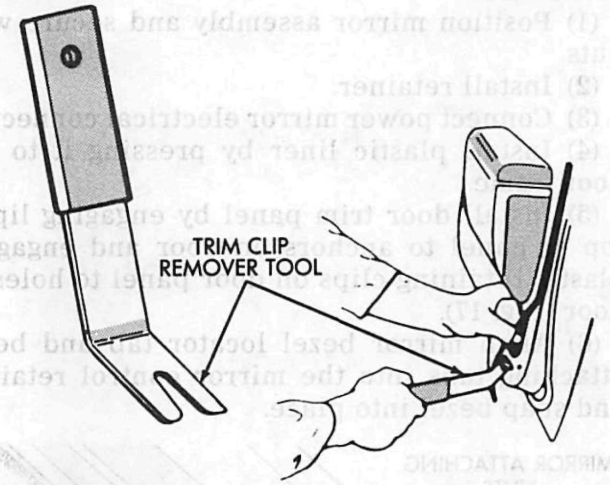


Fig. 14—Remove Door Trim Panel

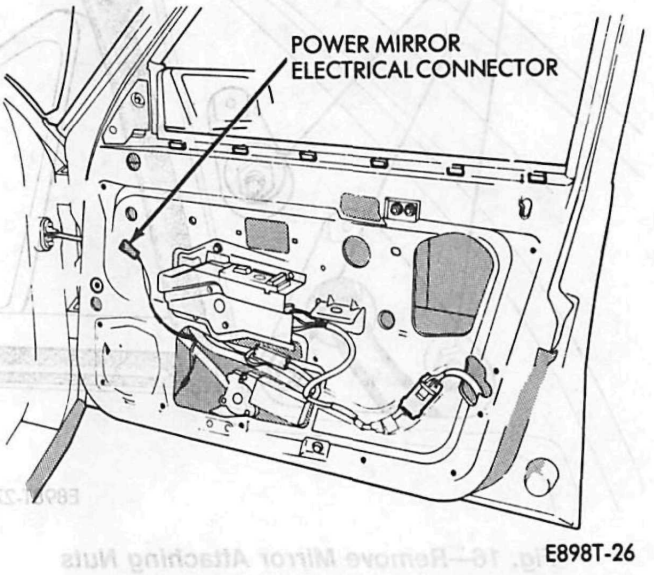


Fig. 15—Disconnect Power Mirror Electrical Connector

Installation

(1) Position mirror assembly and secure with nuts.

(2) Install retainer.

(3) Connect power mirror electrical connector.

(4) Install plastic liner by pressing it to the door frame.

(5) Install door trim panel by engaging lip at top of panel to anchors on door and engaging plastic retaining clips on door panel to holes in door (Fig. 17).

(6) Align mirror bezel locator tab and bezel attaching tabs into the mirror control retainer and snap bezel into place.

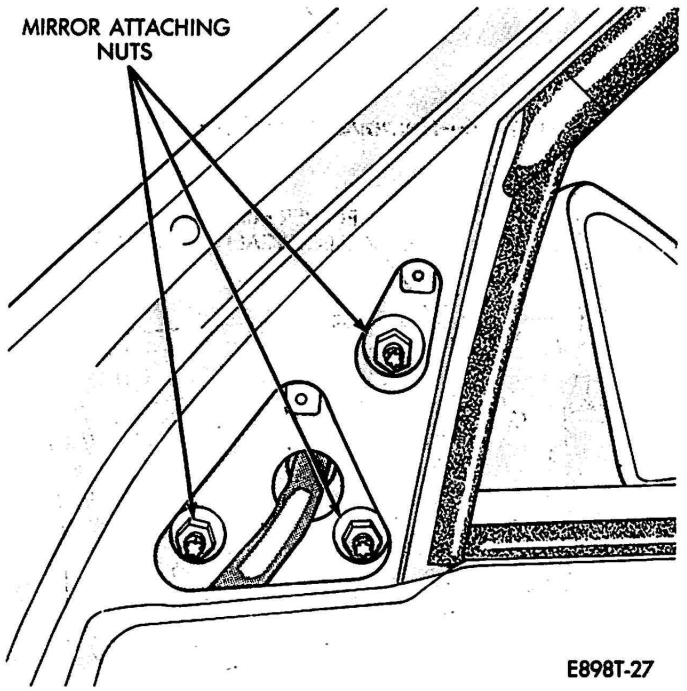


Fig. 16—Remove Mirror Attaching Nuts

(7) Install control switch.

(8) Install door trim panel screw.

(9) Connect electrical connector.

(10) Install door handle.

(11) Install plastic switch cover by engaging the front and snapping the rear into place.

(12) Install lock button by pressing the lock rod until it clicks into place.

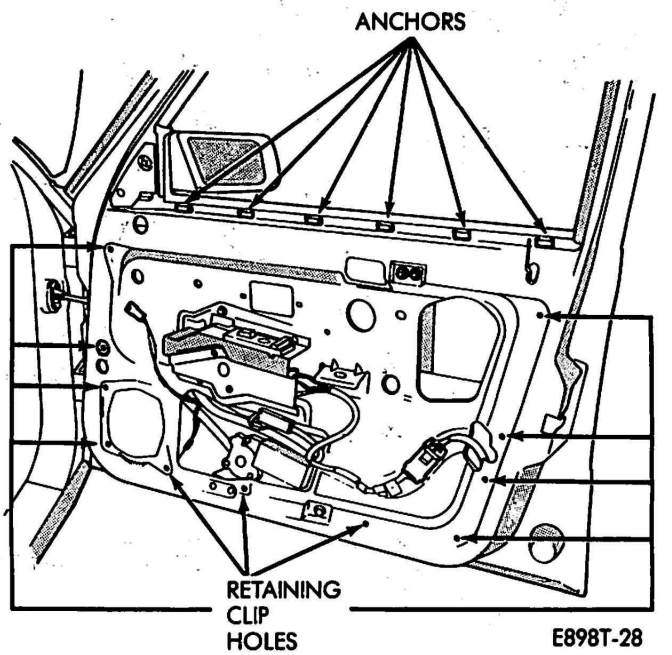


Fig. 17—Install Door Trim Panel

ELECTRICAL WIRING DIAGRAMS

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Circuit Identification	2	Symbols, Fuses, and Connectors	4
Fuse Block	6	Wiring and Components	7
General Information	1	Wiring Diagrams	1
Splice Locations	2		

WIRING DIAGRAMS

GENERAL INFORMATION

The following master wiring diagrams contain the latest information available at time of publication. These diagrams contain various wires, wire routing, wire color codes, switches components, fuses, splices, connectors, connector cavities and other information except distributor secondary wiring. This is shown in (Figs. 1 and 2).

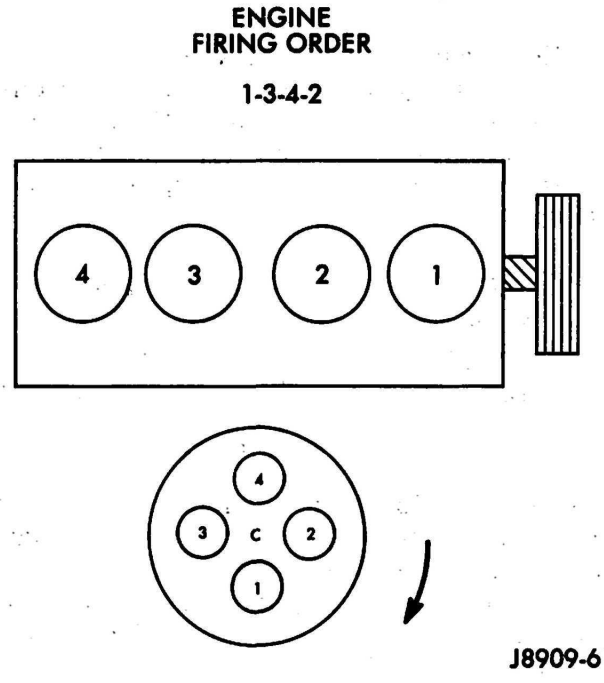


Fig. 1—Distributor Secondary Wiring—2.5L Engine

Each wire shown in the diagrams also contains a code (Fig. 3) which identifies the wires circuit, gauge, and color. The color is shown as a two letter code which can be identified by referring to the wire Color Code Chart. If the wire has a tracer and its a standard color an asterisk will follow the main wire color, if the tracer color is non-standard the main wire code will have a slash (/) after it followed by the tracer color.

To identify which main circuit code applies to a system, refer to the Main Circuit Identification Code Chart.

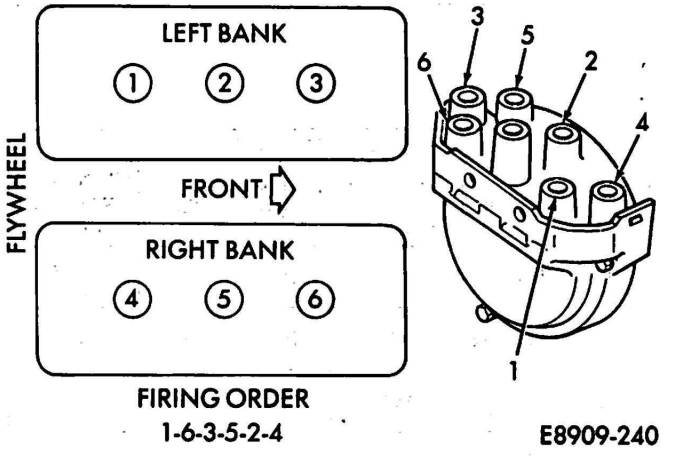


Fig. 2—Distributor Secondary Wiring—3.0L Engine

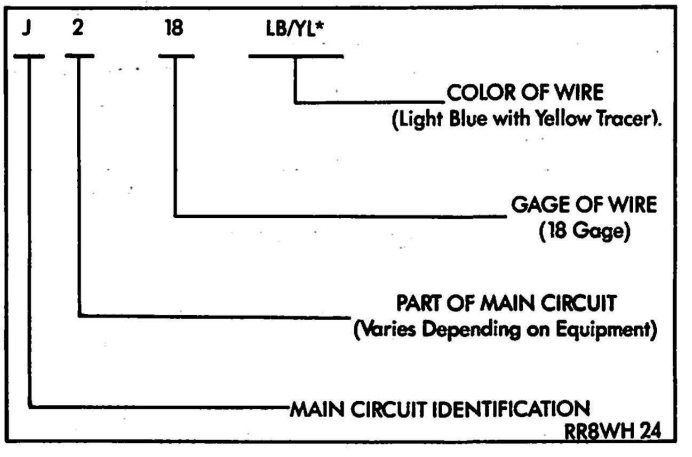


Fig. 3—Wire Color Code Identification

MAIN CIRCUIT IDENTIFICATION CODES

- A BATTERY POSITIVE CIRCUITS, IGNITION SYSTEM CIRCUITS, STARTER SYSTEM, FUEL PUMP, RADIATOR FAN
- B BATTERY FEED
- C SPEED CONTROL, PASSIVE RESTRAINT, A/C HEATER CIRCUITS, REAR WINDOW DEFOGGER, A/C HEATER CONTROL (HEVAC) CIRCUITS
- D DIAGNOSTIC CONNECTOR, PASSIVE RESTRAINT, FUEL IGNITION SYSTEM, A/C HEATER CONTROLS
- E LAMP OUTAGE, RADIO, TRIP COMPUTER, VMM, POD ASSEMBLY, POWER MIRRORS, INSTRUMENT PANEL ILLUMINATION, HEADLAMP MODULE
- F AUTOMATIC TRANSMISSION MODULE, LAMP MODULE, REAR WINDOW DEFOGGER, ILLUMINATED ENTRY MODULE, RADIO, FUSED IGNITION, FUSED BATTERY, BACK-UP LAMPS
- G CHARGING SYSTEM, TACHOMETER, GAUGES, WARNING LAMPS, INTERIOR LAMPS
- H LAMP MODULE
- K FRONT END LIGHTING, SPEED CONTROL
- L EXTERIOR LIGHTING, POWER DOOR LOCKS, STOP LAMPS, TURN SIGNALS
- M TRIP COMPUTER, RADIO, POWER DOOR LOCKS, POWER MIRRORS, INTERIOR LIGHTING, COURTESY LAMPS
- P PASSIVE RESTRAINT, KEYLESS ENTRY
- T TRANSMISSION MODULE, NEUTRAL SAFETY SWITCH, STARTER SOLENOID
- V SPEED CONTROL, WINDSHIELD WIPERS
- W POWER SUNROOF, POWER WINDOWS
- X RADIO, COMPACT DISC PLAYER, HORNS, POWER ANTENNA
- Z GROUND

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WIRE COLOR CODE CHART					
COLOR CODE	COLOR	STANDARD TRACER COLOR	COLOR CODE	COLOR	STANDARD TRACER CODE
BK	BLACK	WT	PK	PINK	BK OR WH
BR	BROWN	WT	RD	RED	WT
DB	DARK BLUE	WT	TN	TAN	WT
DG	DARK GREEN	WT	VT	VIOLET	WT
GY	GRAY	BK	WT	WHITE	BK
LB	LIGHT BLUE	BK	YL	YELLOW	BK
LG	LIGHT GREEN	BK	*	WITH TRACER	
OR	ORANGE	BK			

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LOCATING A SYSTEM OR COMPONENT

In order to locate a system or component use alphabetical index to determine diagram sheet number.

Sheet numbers for each wiring diagram are located at lower right or left hand corner of each sheet. **Page numbers at top of page do not apply to diagram sheet.**

SPLICE LOCATIONS

Splice locations are indicated on master wiring diagrams by a diamond with splice circuit code within it. If there is more than one splice per circuit splice code, a small box will be connected to the diamond with the splice number in it (Fig. 4).



Fig. 4—Wiring Splice Example

In order to locate a particular splice determine splice number from master wiring diagram. Refer to the splice index to find the **figure** number then turn to that **figure** to determine splice location within a wiring harness (Fig. 5). **All connectors are viewed from terminal end.**

FUSIBLE LINKS

Vehicle wiring harnesses are equipped with fusible links to protect against harness damage in the event of a short in the electrical system.

Fusible links are color coded as to wire gauges size. See fusible link chart.

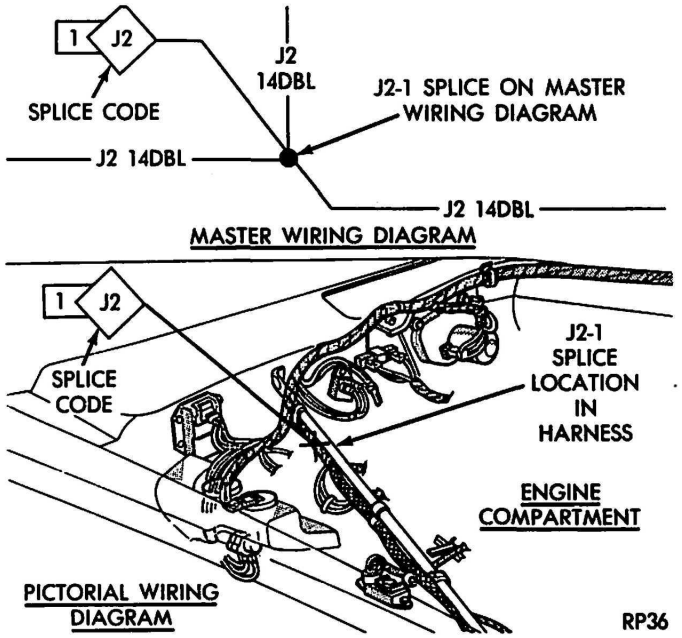


Fig. 5—Locating a Wiring Harness Splice

FUSIBLE LINK CHART		
WIRE GAUGE	COLOR CODE	COLOR
14 Ga.	BR	BROWN
16 Ga.	BK	BLACK
18 Ga.	BL	BLUE
20 Ga.	GY	GRAY

FUSIBLE LINK REPLACEMENT

CAUTION: Do not replace blown fusible links with standard wire. Only fusible type wire with hypalon insulation can be used or damage to the electrical system will occur. Also make sure correct gauge of wiring is used. Refer to Master Wiring Diagrams for proper gauge size.

(1) When a fusible link blows it is very important to find out why it blew. They are placed in vehicle electrical systems for protection against dead shorts to ground which can be caused by electrical component failure or various wiring failures. **Do not just replace fusible link to correct problems.**

(2) When replacing fusible links that are connected to battery terminal of starter relay, they are to be serviced with the same type of prefabricated fusible link.

All other fusible links are replaced with a piece of fusible link wire cut from bulk reels. Care must be taken that the same gauge and color wire as the original fusible link be used (see Fusible Link Chart).

Multiple Fusible Link Replacement

(1) Disconnect negative battery cable.

(2) Cut off any remaining portion of blown fusible link flush with multiple connection insulator, taking care not to cut into other fusible links (Fig. 6).

(3) Remove 1 inch of insulation from main harness wire about 1 inch from multiple connection insulator (Fig. 6).

(4) Remove 1 inch of insulation from one end of new fusible link and wrap it around main harness wire that was stripped (Fig. 6).

(5) Heat splice with a high temperature soldering gun, apply rosin type solder until it flows freely, and remove soldering gun. **Do not use acid core solder.**

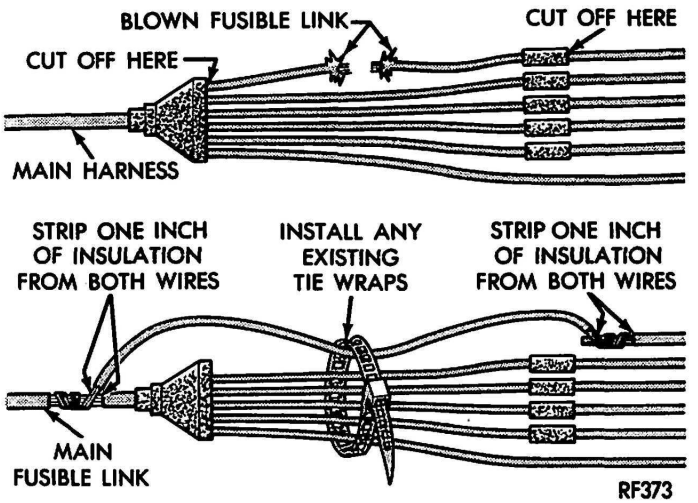


Fig. 6—Fusible Link Repair

(6) Allow to cool and wrap new splice with a minimum of 3 layers of suitable electrical tape.

Single Fusible Link Replacement

(1) Disconnect negative battery cable.

(2) Cut fusible link including connection insulator from main harness wire (Fig. 6).

(3) Remove 1 inch of insulation from both new fusible link and main harness wire and wrap together (Fig. 6).

(4) Heat splice with a high temperature soldering gun, apply rosin type solder until it flows freely and remove soldering gun. **Do not use acid core solder.**

(5) Allow to cool and wrap new splice with a minimum of 3 layers or suitable electrical tape.

SYMBOLS, FUSES, AND CONNECTORS

Various symbols are used on wiring diagrams. These symbols can be identified by referring to symbol identification (Fig. 7).

Fuse identification can be found on the Fuse Block chart.

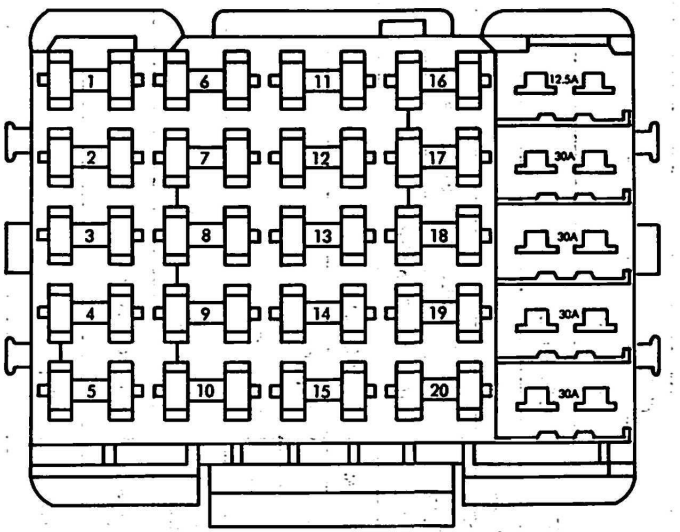
CAUTION: When replacing a blown fuse, it is important to replace it with a fuse having the correct amperage rating. The use of a fuse with a rating other than indicated may result in a dangerous electrical overload. If a proper rated fuse continues to blow, it indicates a problem that should be corrected.

LEGEND OF SYMBOLS USED ON WIRING DIAGRAMS			
+	POSITIVE		CONNECTOR
−	NEGATIVE		MALE CONNECTOR
	GROUND		FEMALE CONNECTOR
	FUSE		DENOTES WIRE CONTINUES ELSEWHERE
	GANG FUSES WITH BUSS BAR		DENOTES WIRE GOES TO ONE OF TWO CIRCUITS
	CIRCUIT BREAKER		SPLICE
	CAPACITOR	J2 2	SPLICE IDENTIFICATION
Ω	OHMS		THERMAL ELEMENT
	RESISTOR	TIMER	TIMER
	VARIABLE RESISTOR		MULTIPLE CONNECTOR
	SERIES RESISTOR		OPTIONAL WIRING WITH / WIRING WITHOUT
	COIL		"Y" WINDINGS
	STEP UP COIL	88:88	DIGITAL READOUT
	OPEN CONTACT		SINGLE FILAMENT LAMP
	CLOSED CONTACT		DUAL FILAMENT LAMP
	CLOSED SWITCH		L.E.D. — LIGHT EMITTING DIODE
	OPEN SWITCH		THERMISTOR
	CLOSED GANGED SWITCH		GAUGE
	OPEN GANGED SWITCH		SENSOR
	TWO POLE SINGLE THROW SWITCH		FUEL INJECTOR
	PRESSURE SWITCH	#36	DENOTES WIRE GOES THROUGH BULKHEAD DISCONNECT
	SOLENOID SWITCH	#19 STRG COLUMN	DENOTES WIRE GOES THROUGH STEERING COLUMN CONNECTOR
	MERCURY SWITCH	INST PANEL #14	DENOTES WIRE GOES THROUGH INSTRUMENT PANEL CONNECTOR
	DIODE OR RECTIFIER	ENG #7	DENOTES WIRE GOES THROUGH GROMMET TO ENGINE COMPARTMENT
	BY-DIRECTIONAL ZENER DIODE		DENOTES WIRE GOES THROUGH GROMMET
	MOTOR		HEATED GRID ELEMENTS
	ARMATURE AND BRUSHES		908W-191

Fig. 7—Legend

CAVITY	FUSE/ COLOR	ITEMS FUSED
1		
2	15 AMP BLUE	MIRRORS, CHIME, IOD,VMM, COURTESY LAMPS, TRIP COMPUTER RADIO, DECKLID RELEASE, KEYLESS ENTRY, DOME LAMP, ILL. ENTRY MODULE, UNDERHOOD-GLOVE BOX-TRUNK LAMPS, VDS MODULE
3	5 AMP ORANGE	BACK-UP LAMPS
4	5 AMP ORANGE	VANITY LAMPS
5	20 AMP YELLOW	RADIO, CIGAR LIGHTER, RADIO LAMP
6	5 AMP ORANGE	
7	7.5 AMP VIOLET	AUTOMATIC TRANSMISSION
8	15 AMP BLUE	TRIP COMPUTER, VMM, CHIME SYSTEM ILLUMINATION ENTRY, REAR DEFOGGER RELAY BACK-UP LAMPS, CLOCK, TRANSMISSION COMPUTER (IGNITION)
9	15 AMP BLUE	LAMP CONTROL SYSTEM (IGNITION)
10	10 AMP RED	INSTRUMENT CLUSTER DISPLAYS, HEATER CONTROLS LAMP OUTAGE MODULE, HEATER A/C CONTROLS, PASSIVE RESTRAINT MODULE
11		
12	20 AMP YELLOW	STOP/TURN, HAZARD, PARK, SIDE MARKER AND LICENSE LAMPS (LEFT SIDE)
13	3 AMP VIOLET	INSTRUMENT PANEL ILLUMINATION LCD
14	3 AMP VIOLET	INSTRUMENT PANEL ILLUMINATION, CLOCK, HEATER REAR WINDOW
15	10 AMP RED	INSTRUMENT CLUSTER
16	30 AMP GREEN	REAR DEFOGGER, POWER ANTENNA
17		
18	20 AMP YELLOW	STOP/TURN, PARK, SIDE MARKER AND LICENSE LAMPS (RIGHT SIDE)
19	10 AMP RED	(BATTERY) PASSIVE RESTRAINT SYSTEM
20	20 AMP WHITE	STOP/TURN, HAZARD, PARK, SIDE MARKER AND LICENSE LAMPS (RIGHT SIDE)
21	CIRCUIT BREAKER	HEADLAMPS
22	CIRCUIT BREAKER	POWER SEATS, POWER DOOR LOCKS

AMPS	FUSE	COLOR CODE
3	VT	VIOLET
5	OR	ORANGE
7.5	VT	VIOLET
10	RD	RED
15	BL	BLUE
20	YL	YELLOW
20	WT	WHITE
30	GN	GREEN



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Fig. 8—Fuse Block

COMPONENT IDENTIFICATION

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Overhead Console Wiring	3
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Roof Wiring	2
Underhood Lamp	14
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3.0L Engine Wiring	16, 17

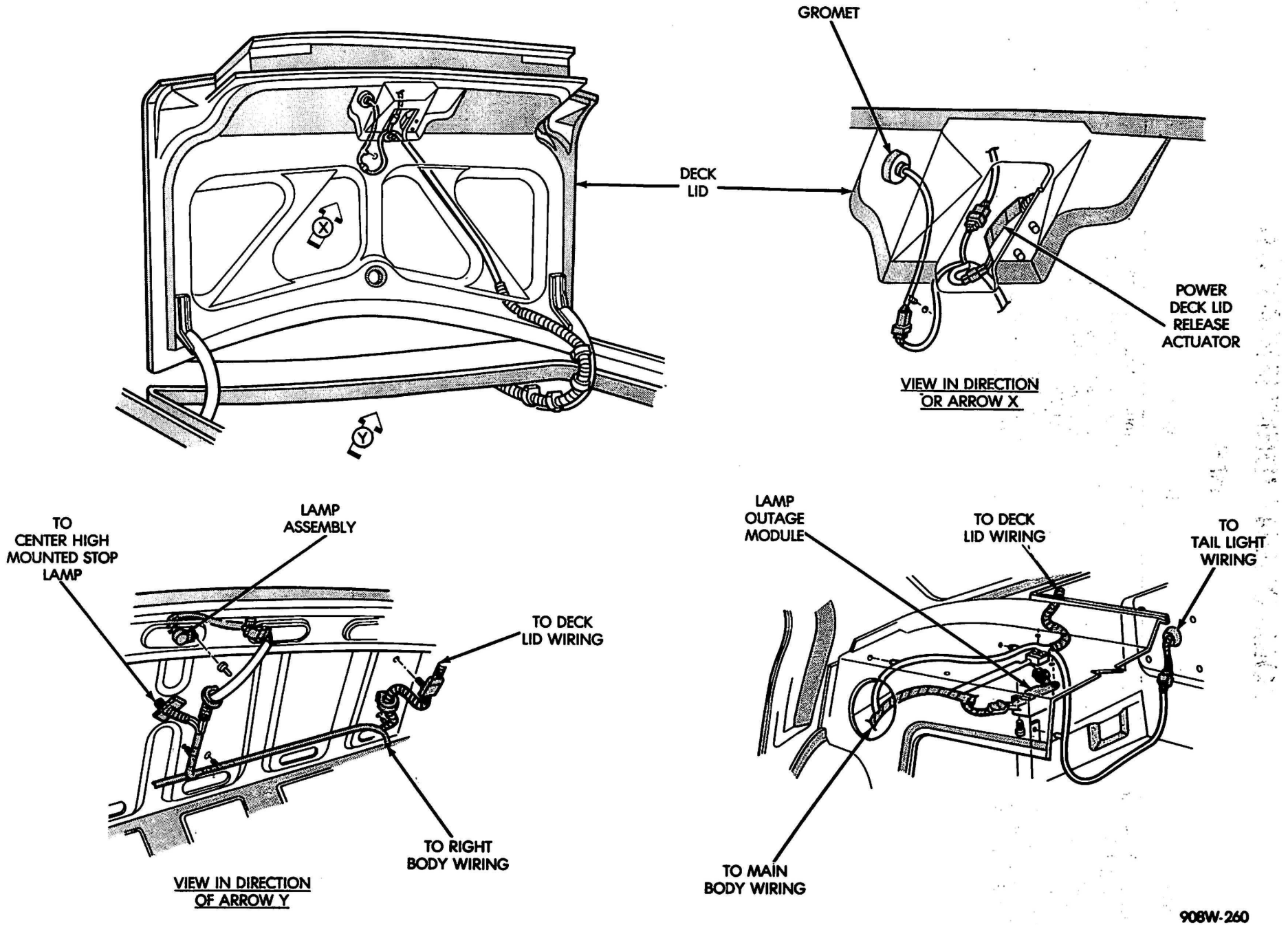


Fig. 1—Deck Lid Wiring

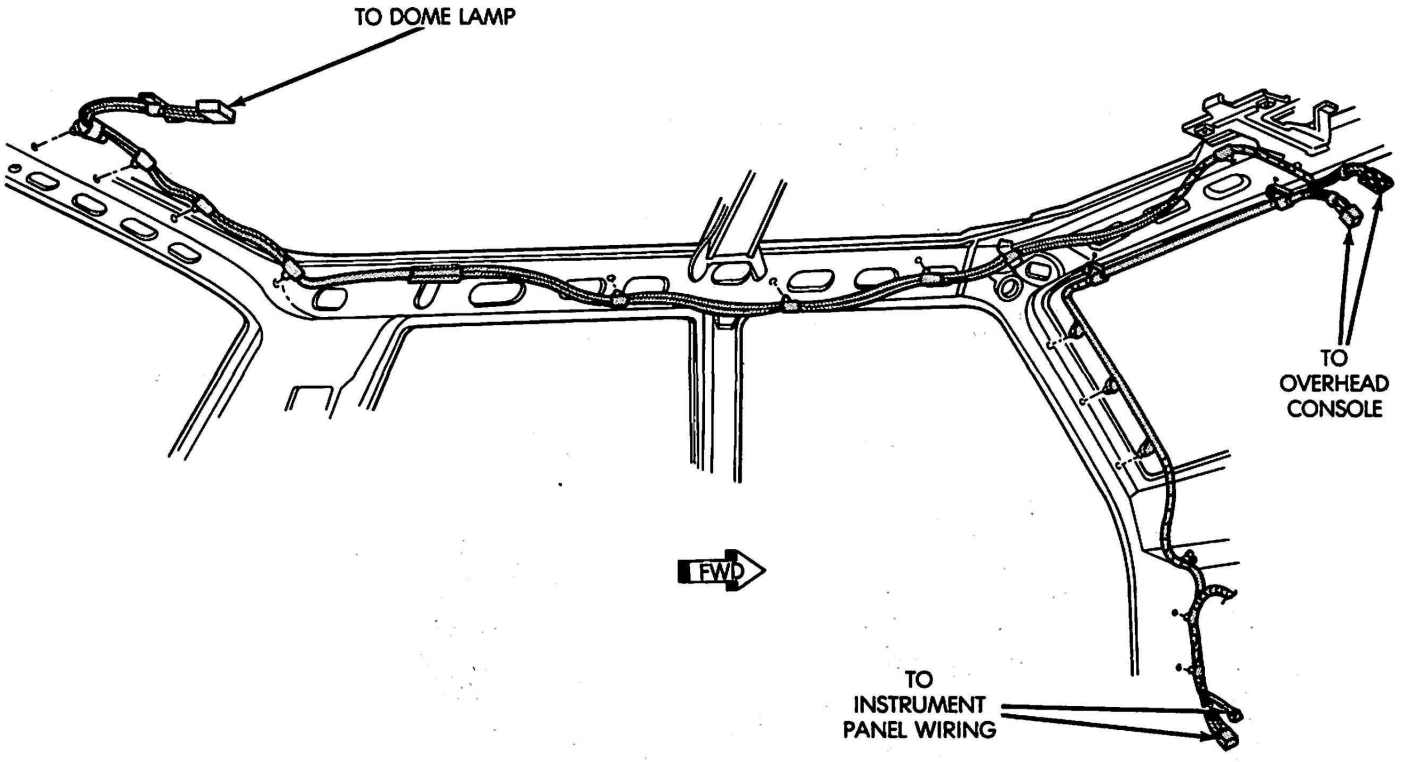


Fig. 2—Roof Wiring

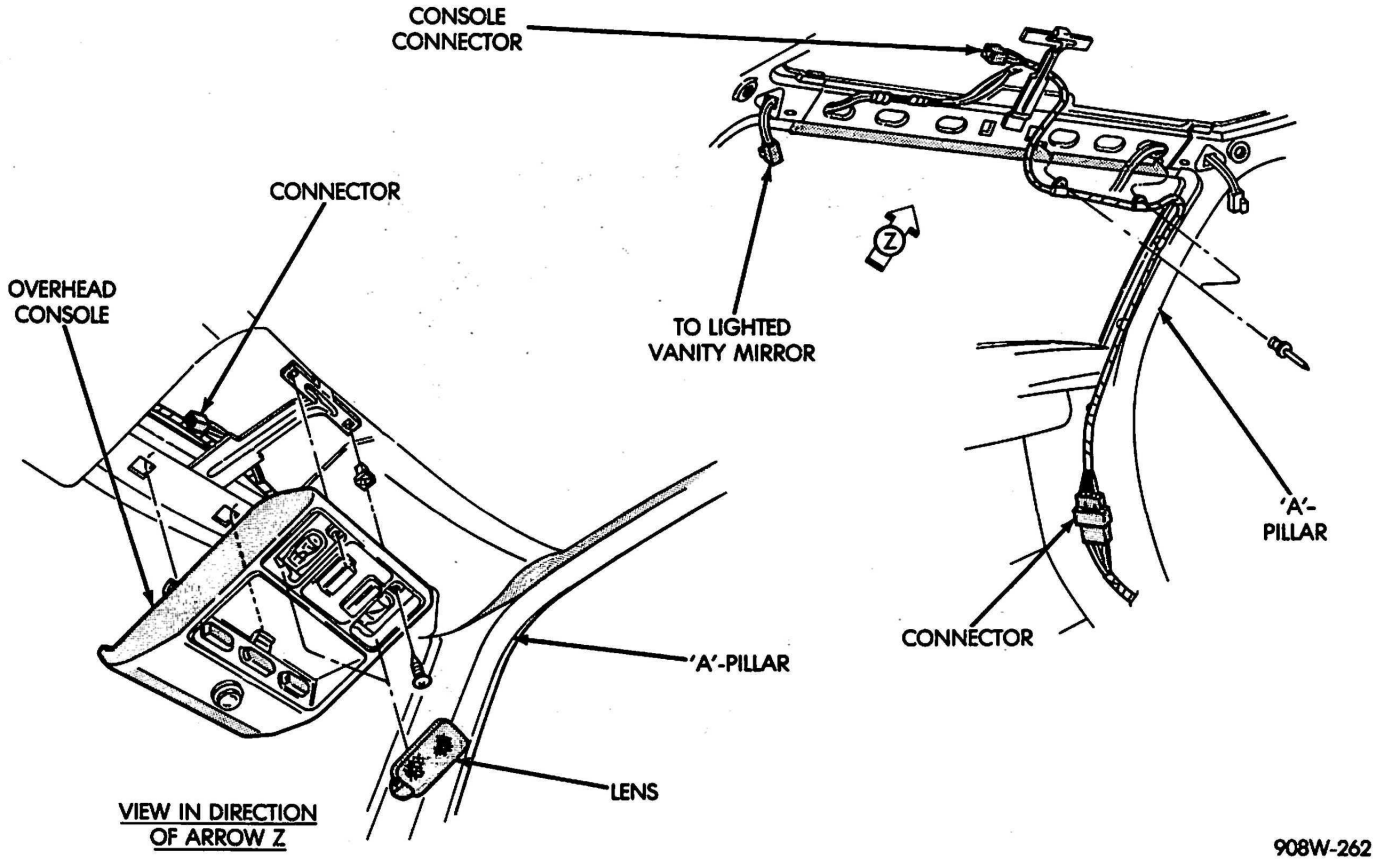


Fig. 3—Overhead Console Wiring

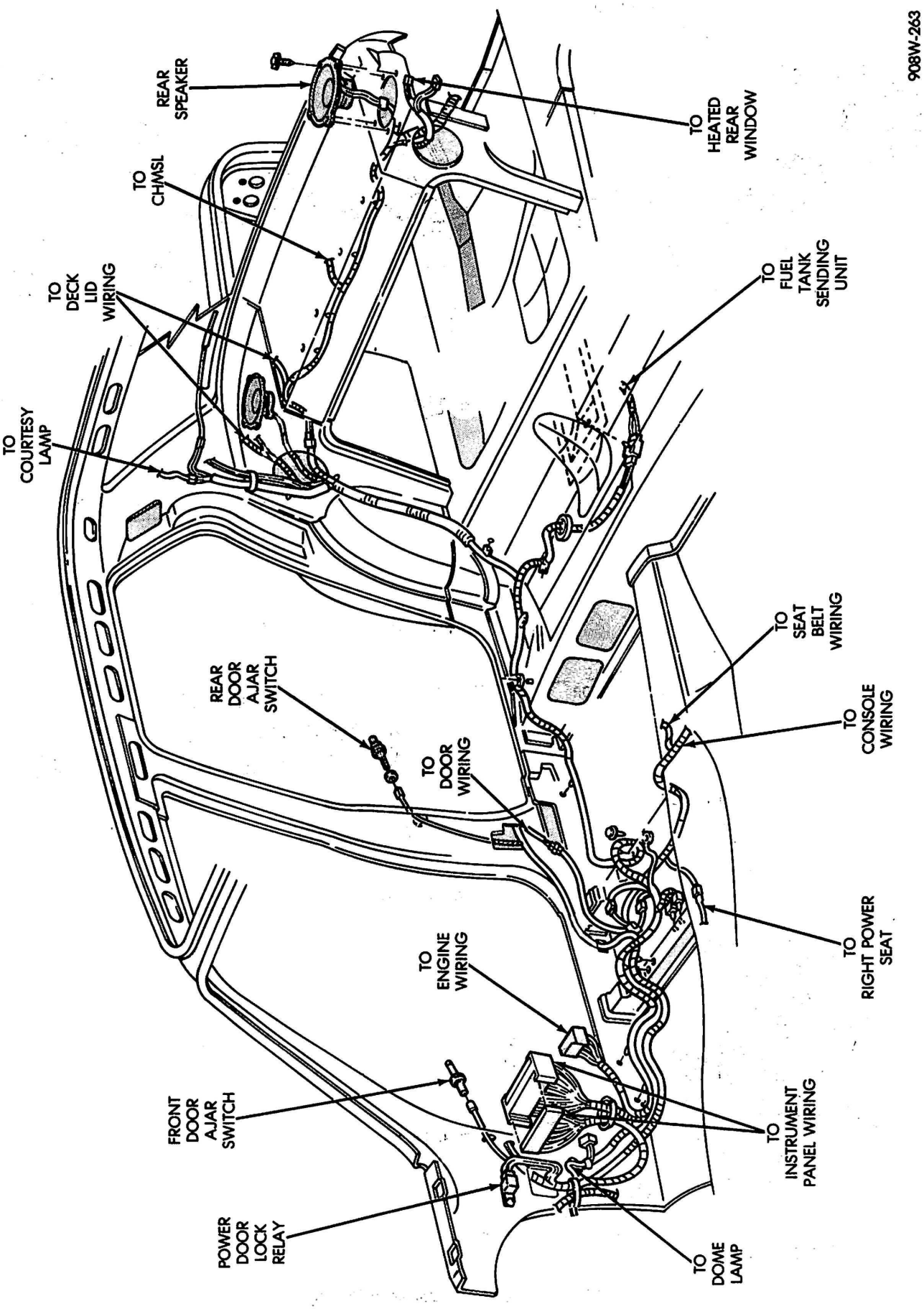


Fig. 4—Body Right Side Wiring

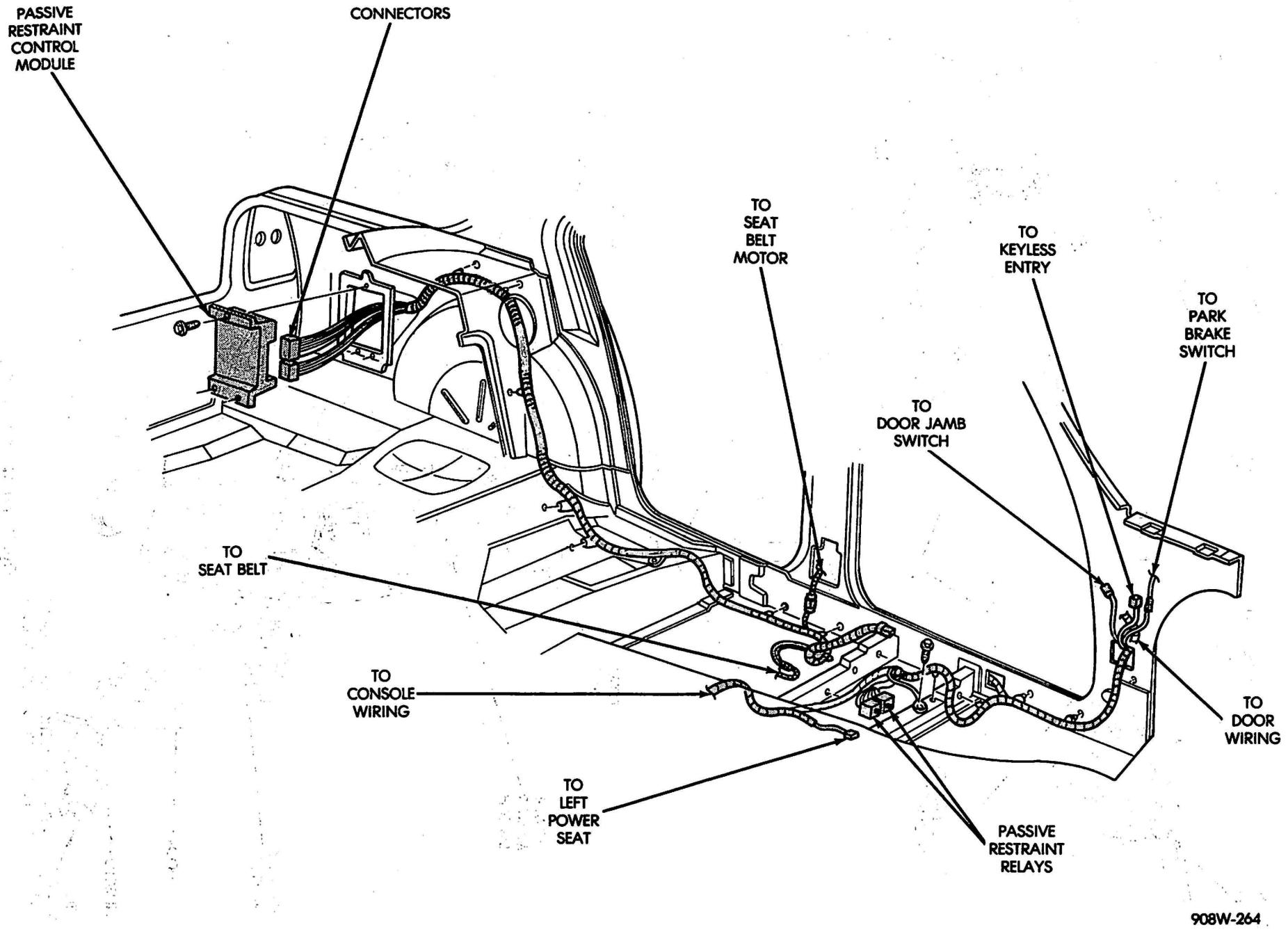


Fig. 5—Body Left Side Wiring

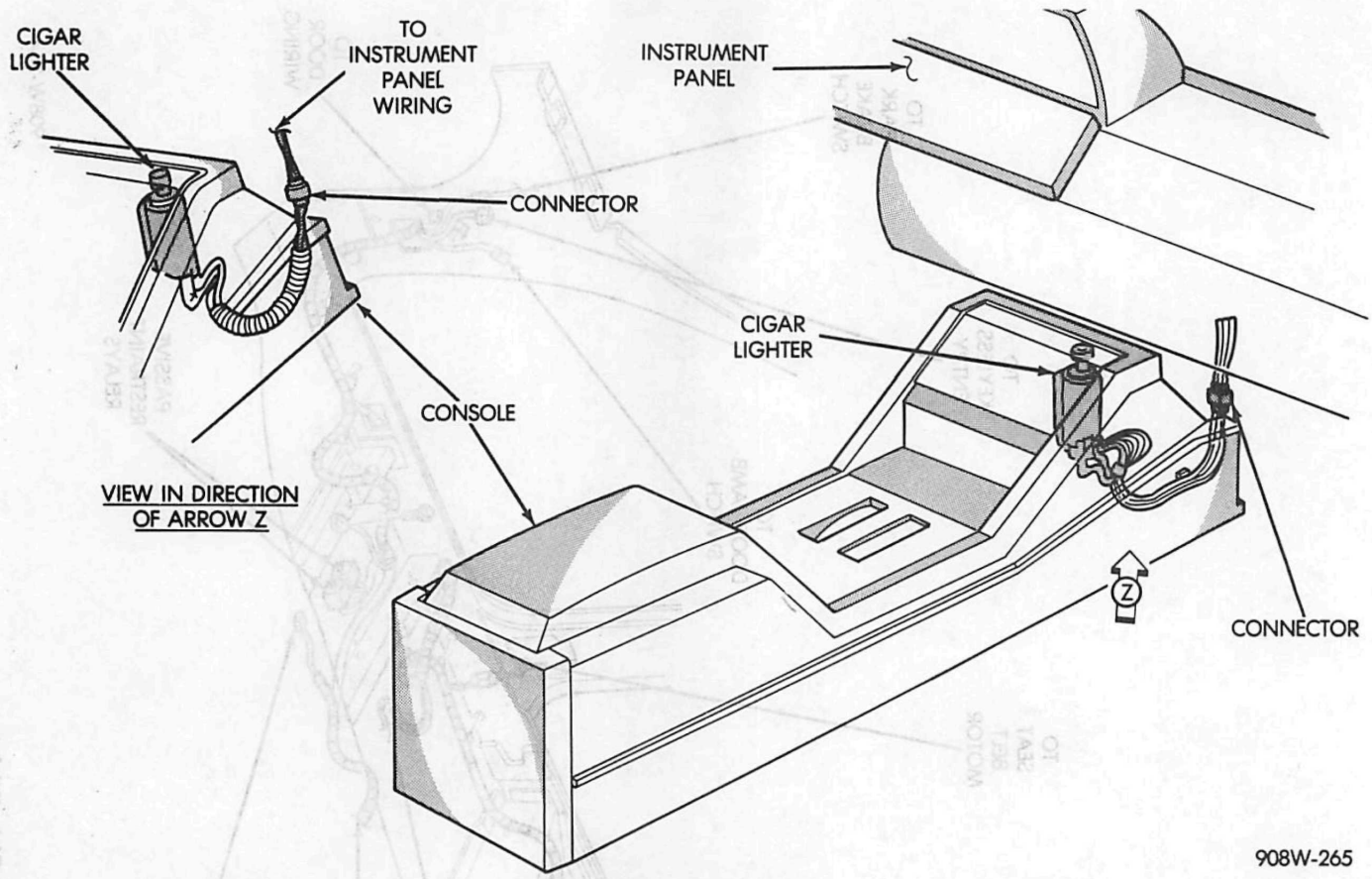


Fig. 6—Console Wiring

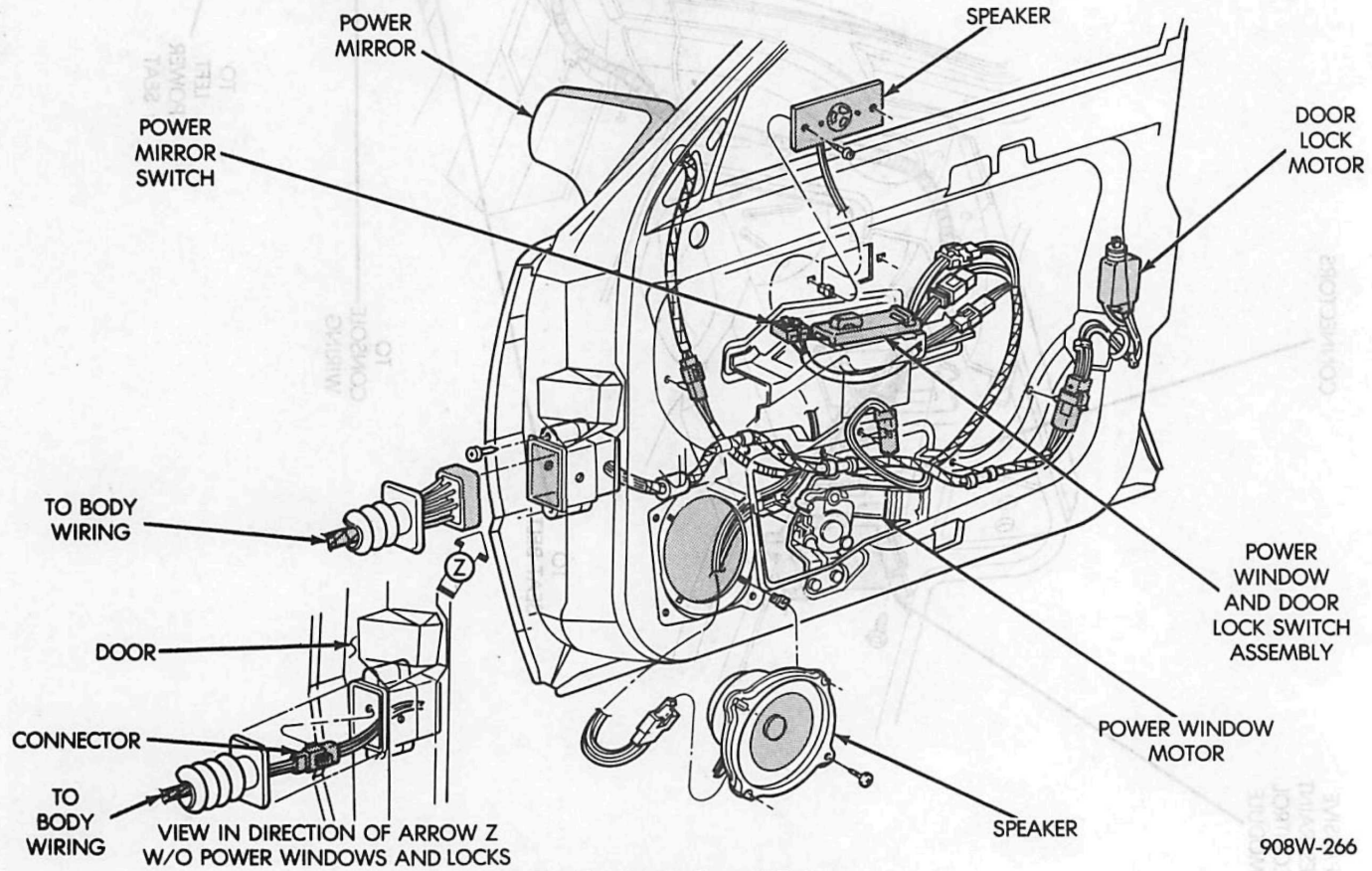


Fig. 7—Front Door Wiring

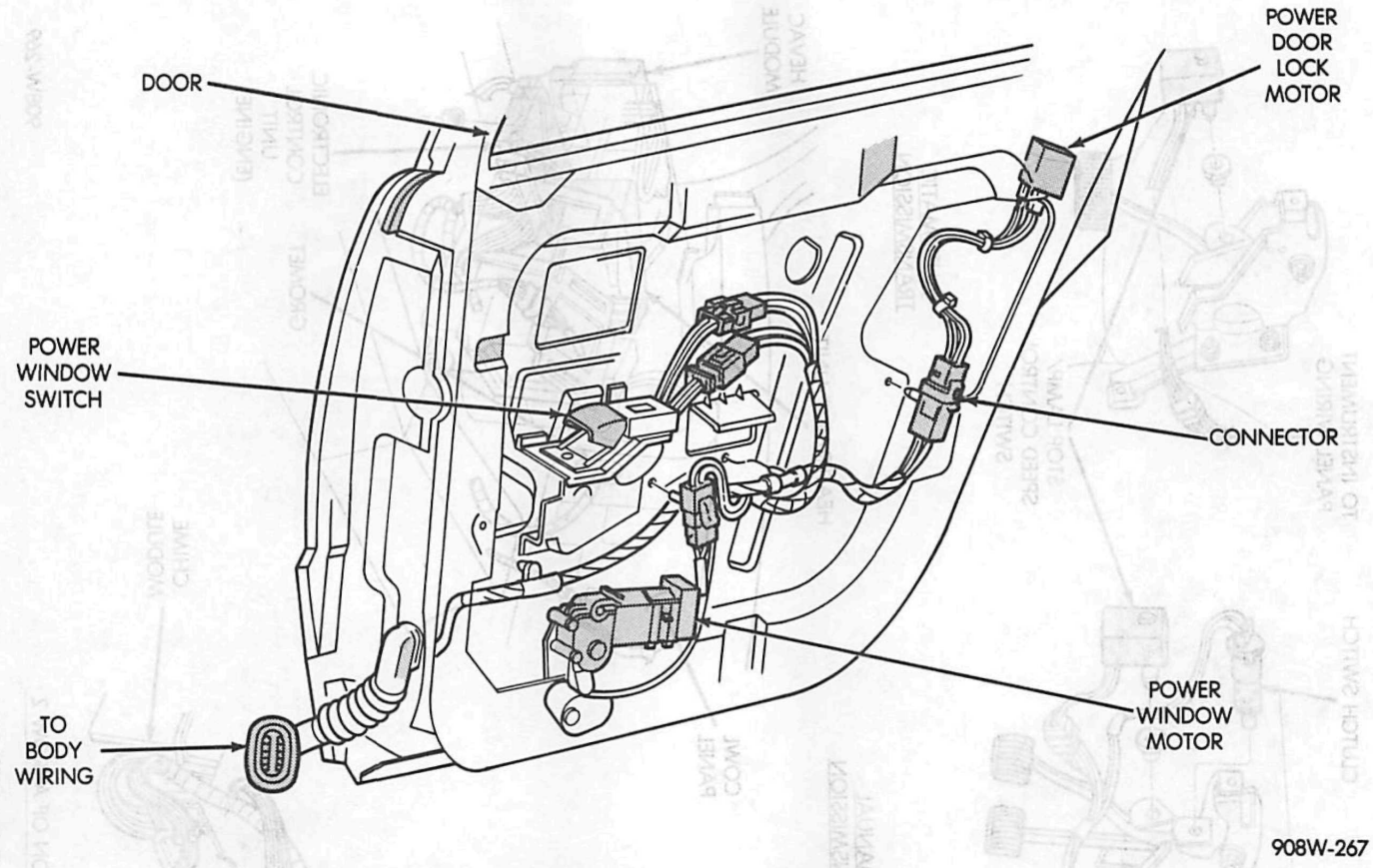


Fig. 8—Rear Door Wiring

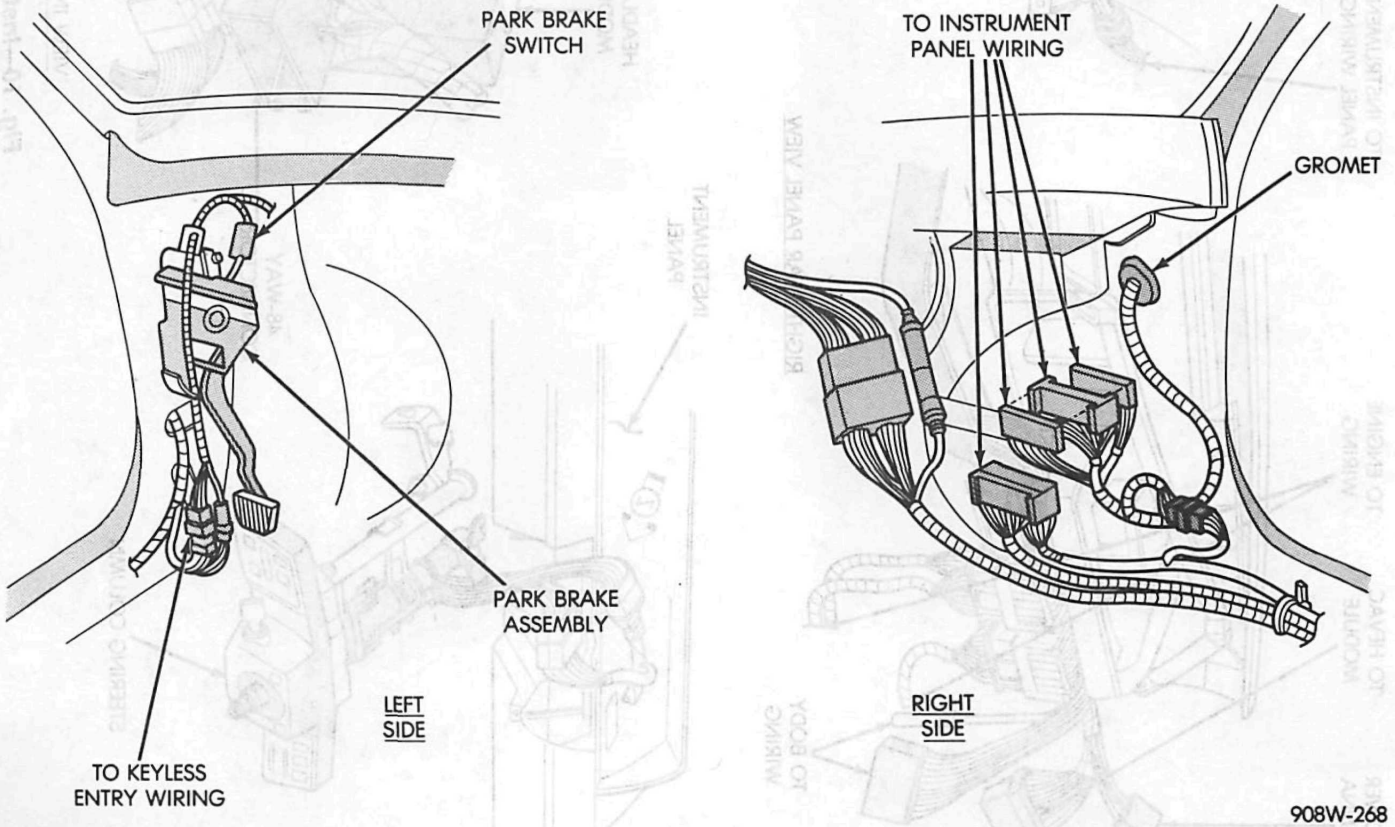


Fig. 9—Cowl Panel Wiring

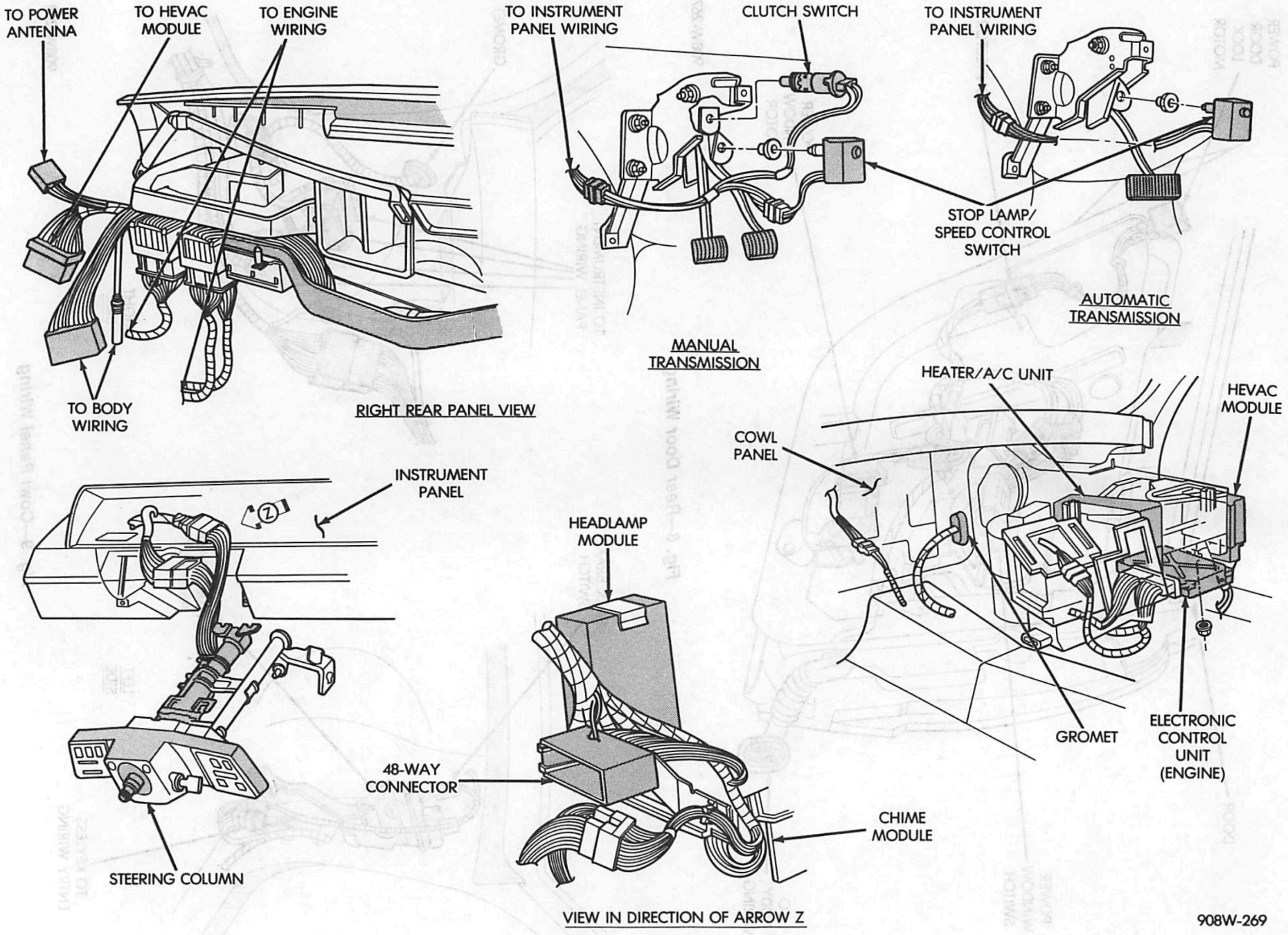


Fig. 10—Instrument Panel Wiring

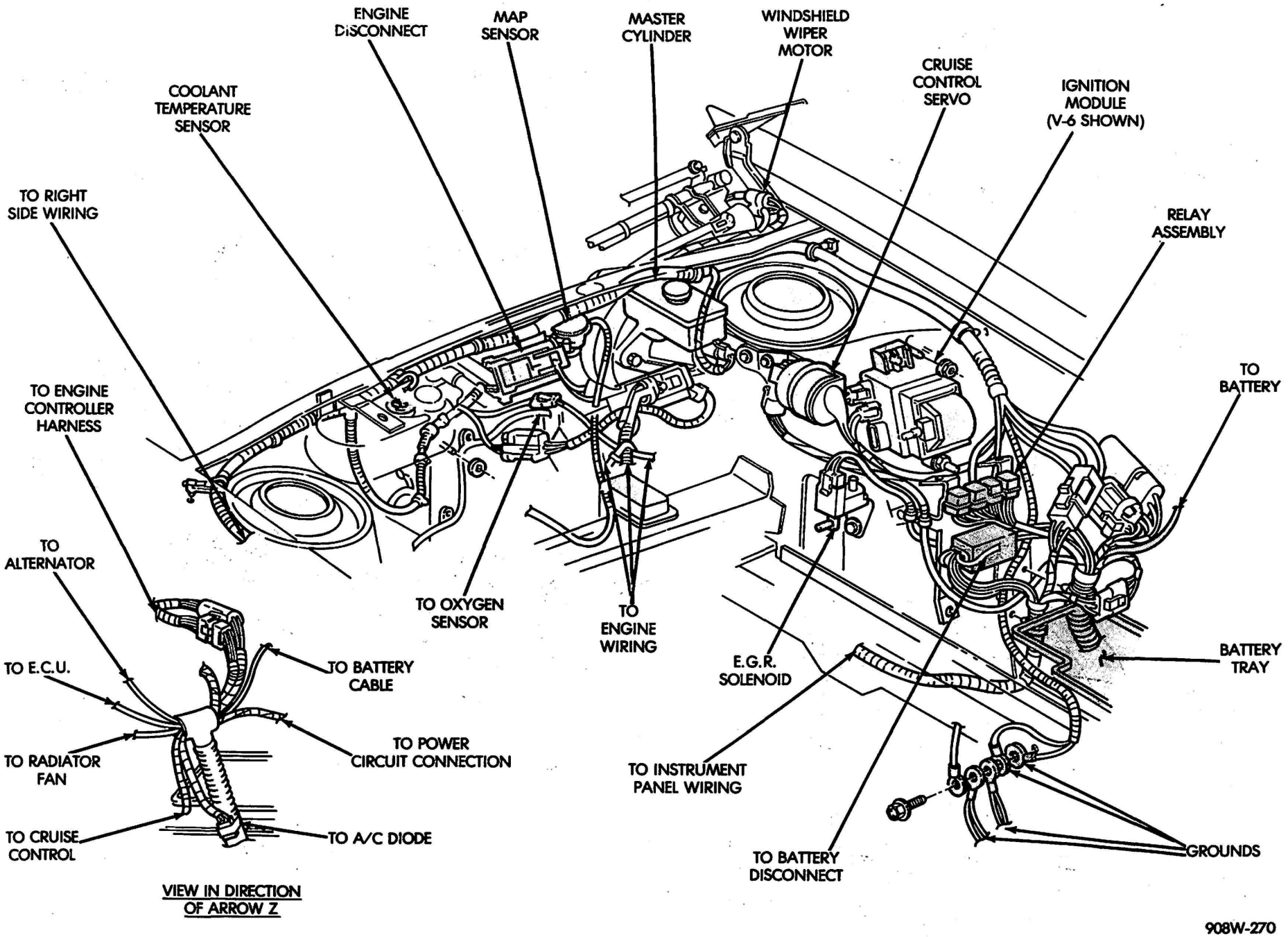


Fig. 11—Engine Compartment Wiring

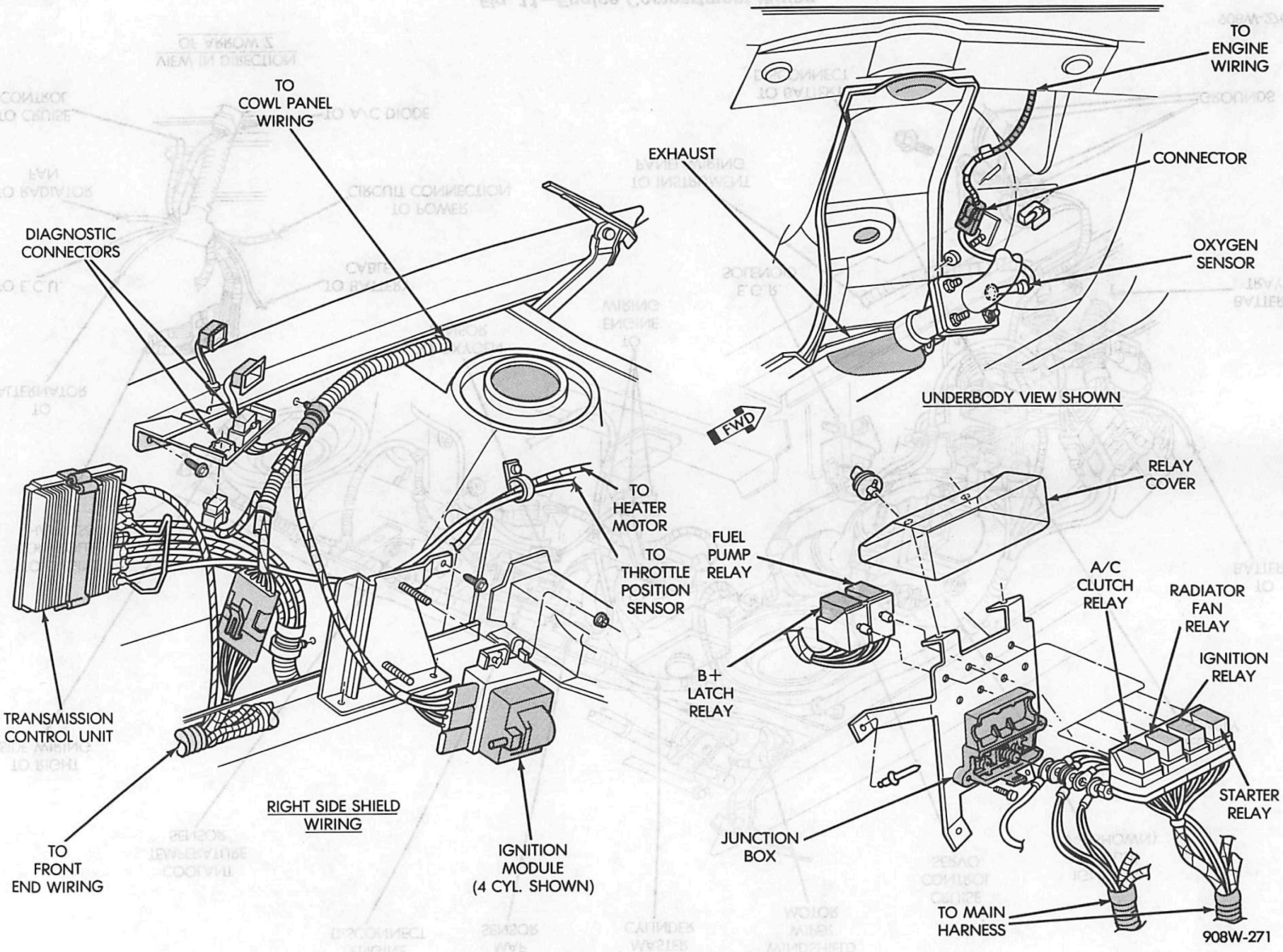


Fig. 12—Engine Compartment Wiring

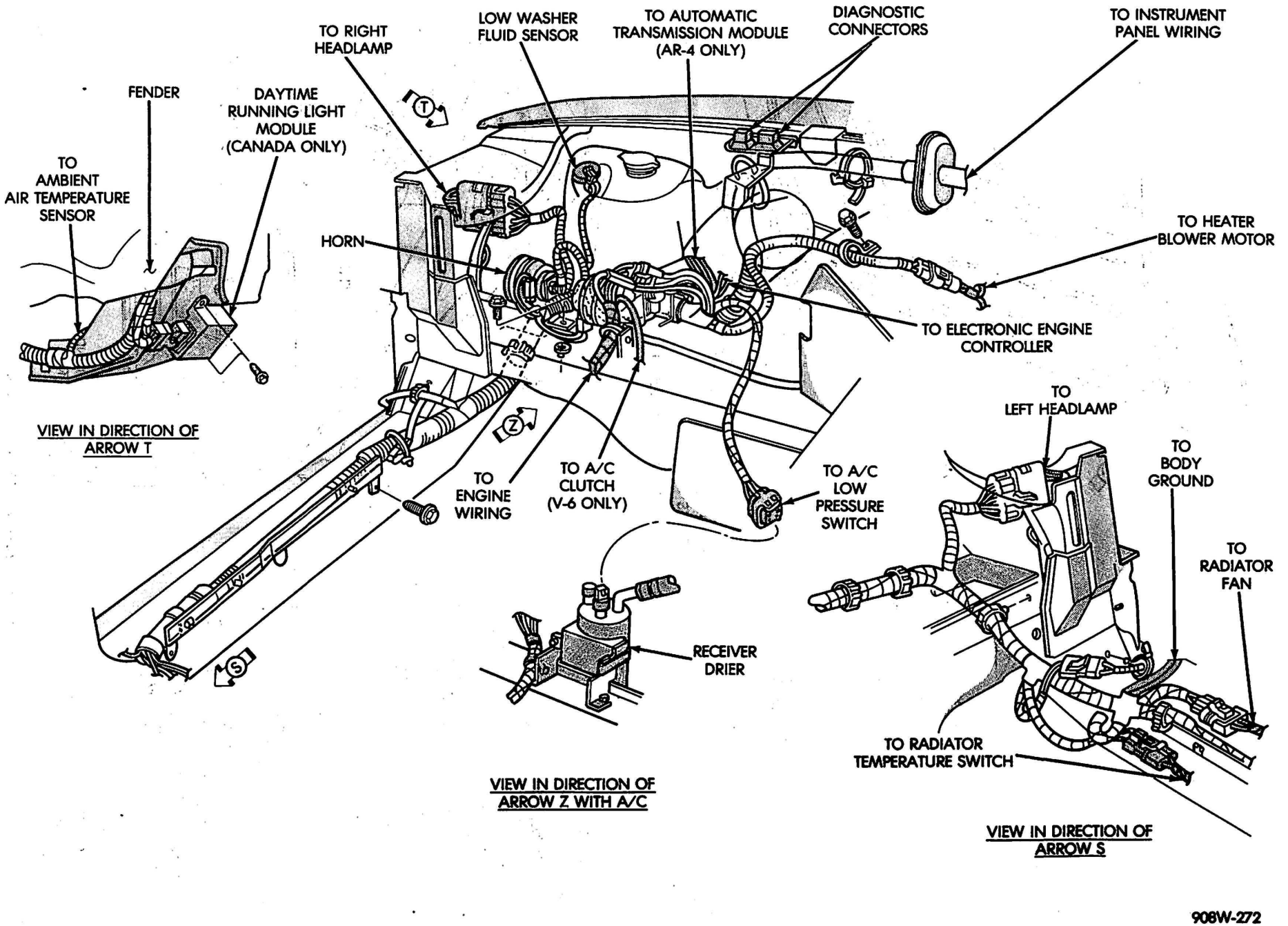


Fig. 13—Front End Wiring

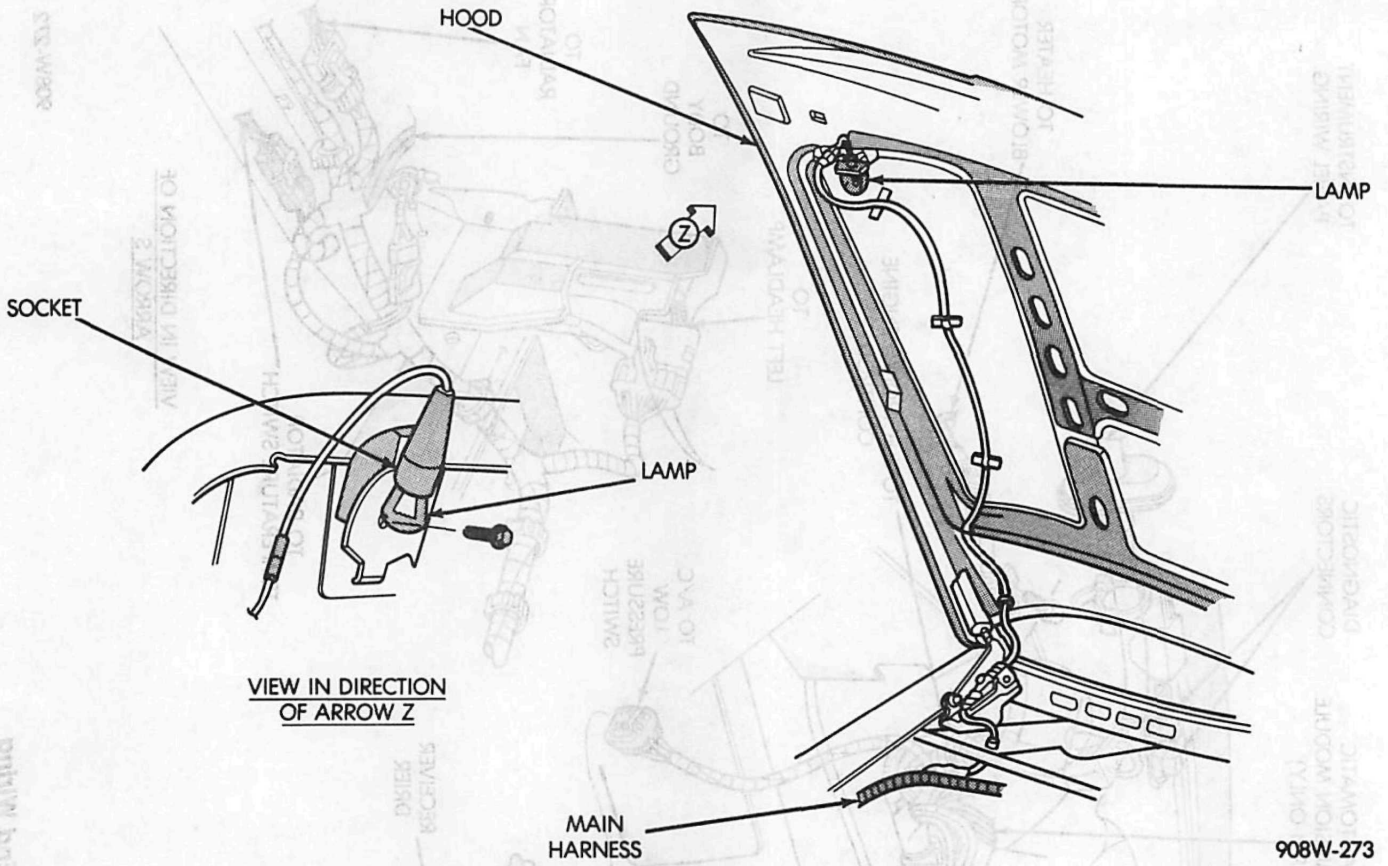


Fig. 14—Underhood Lamp

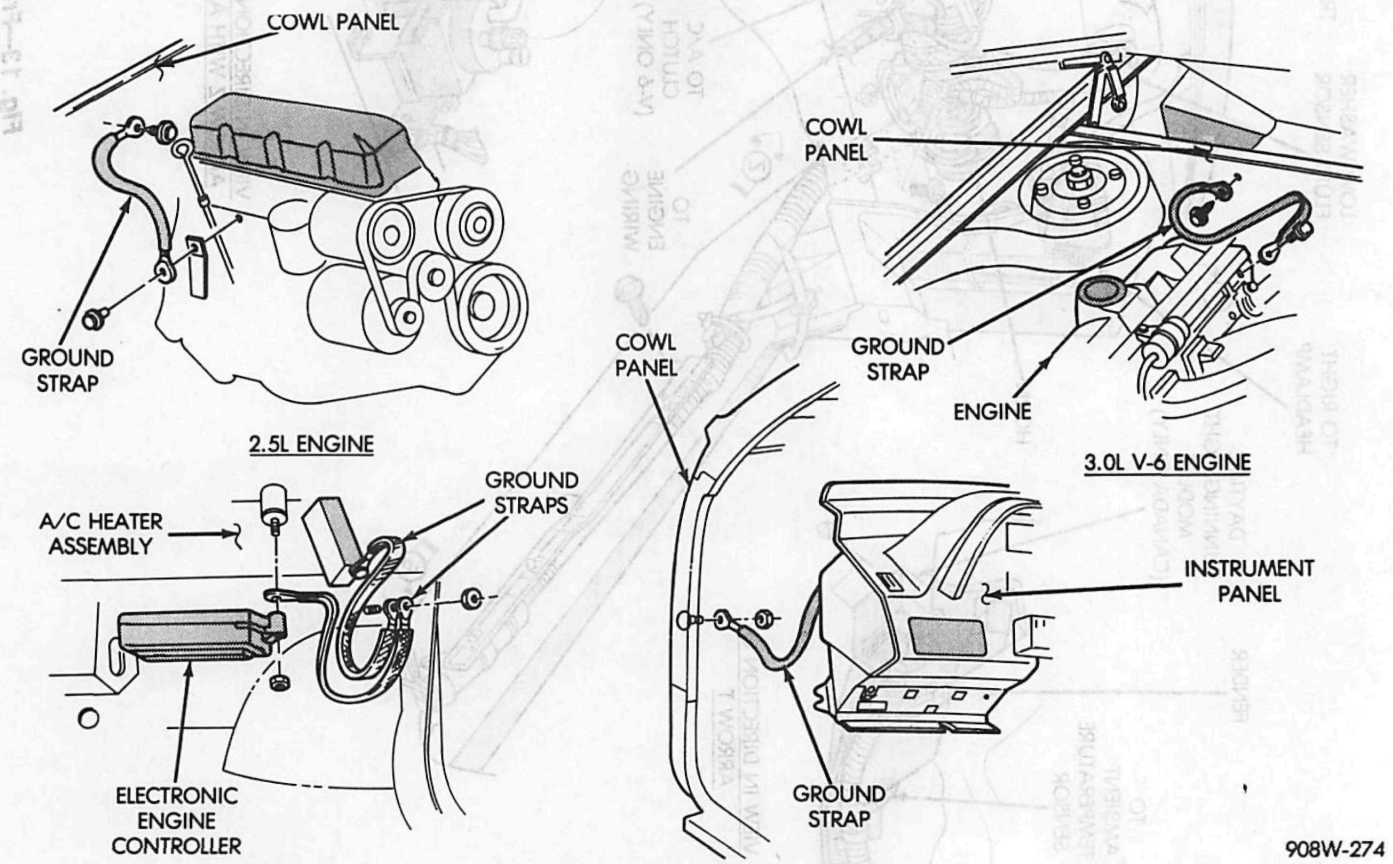


Fig. 15—Ground Strap Location

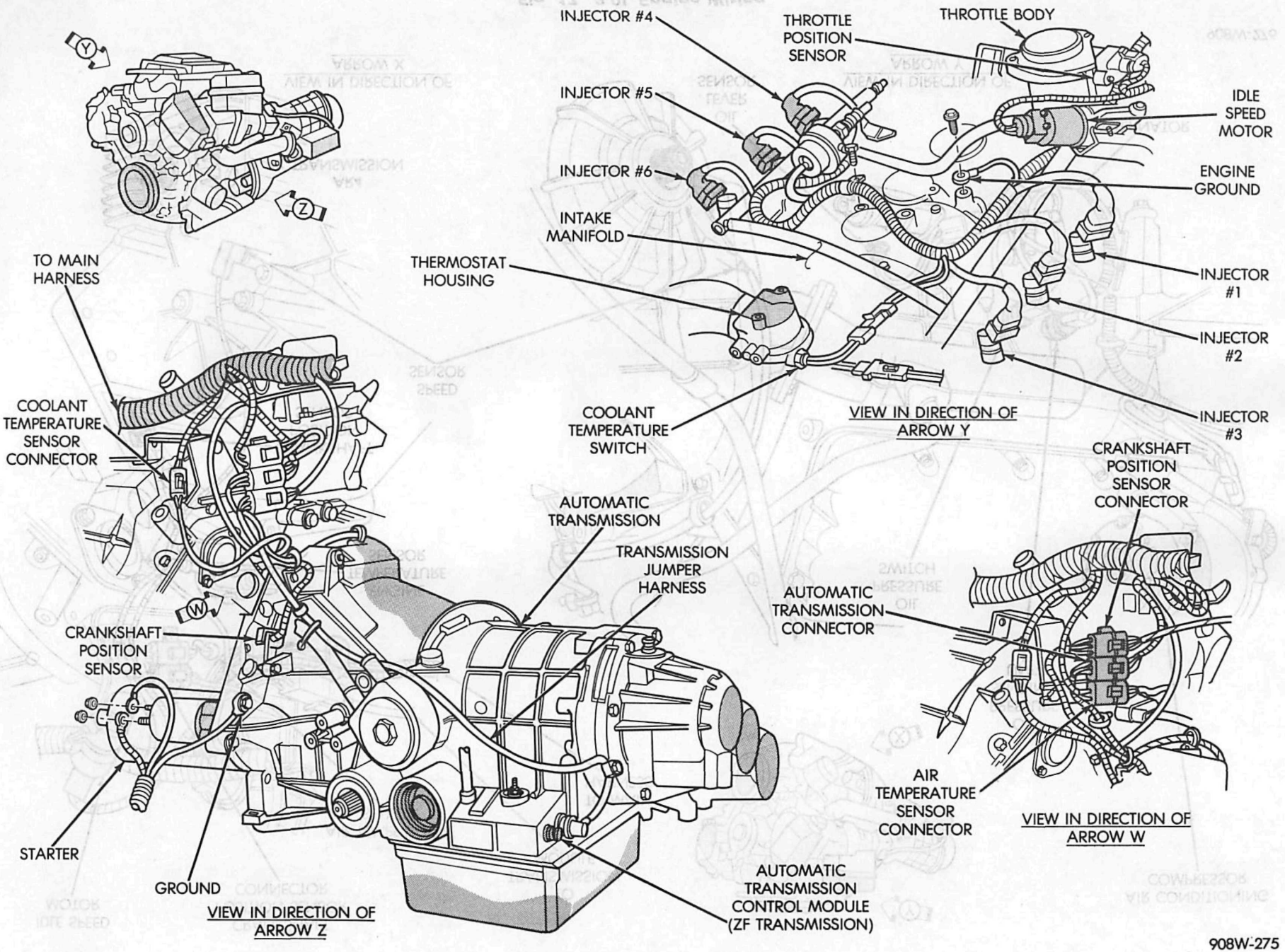


Fig. 16—3.0L Engine Wiring

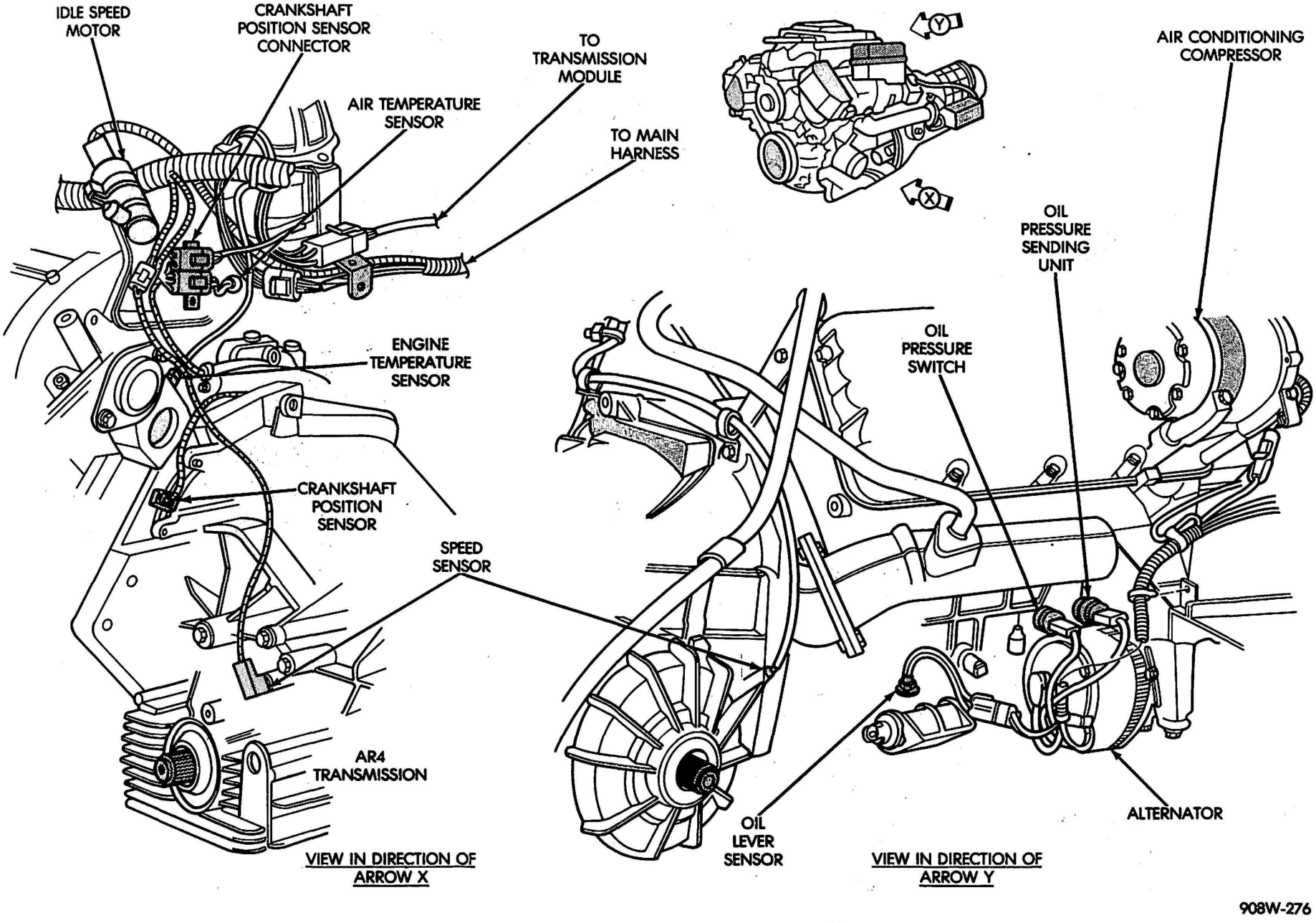


Fig. 17—3.0L Engine Wiring

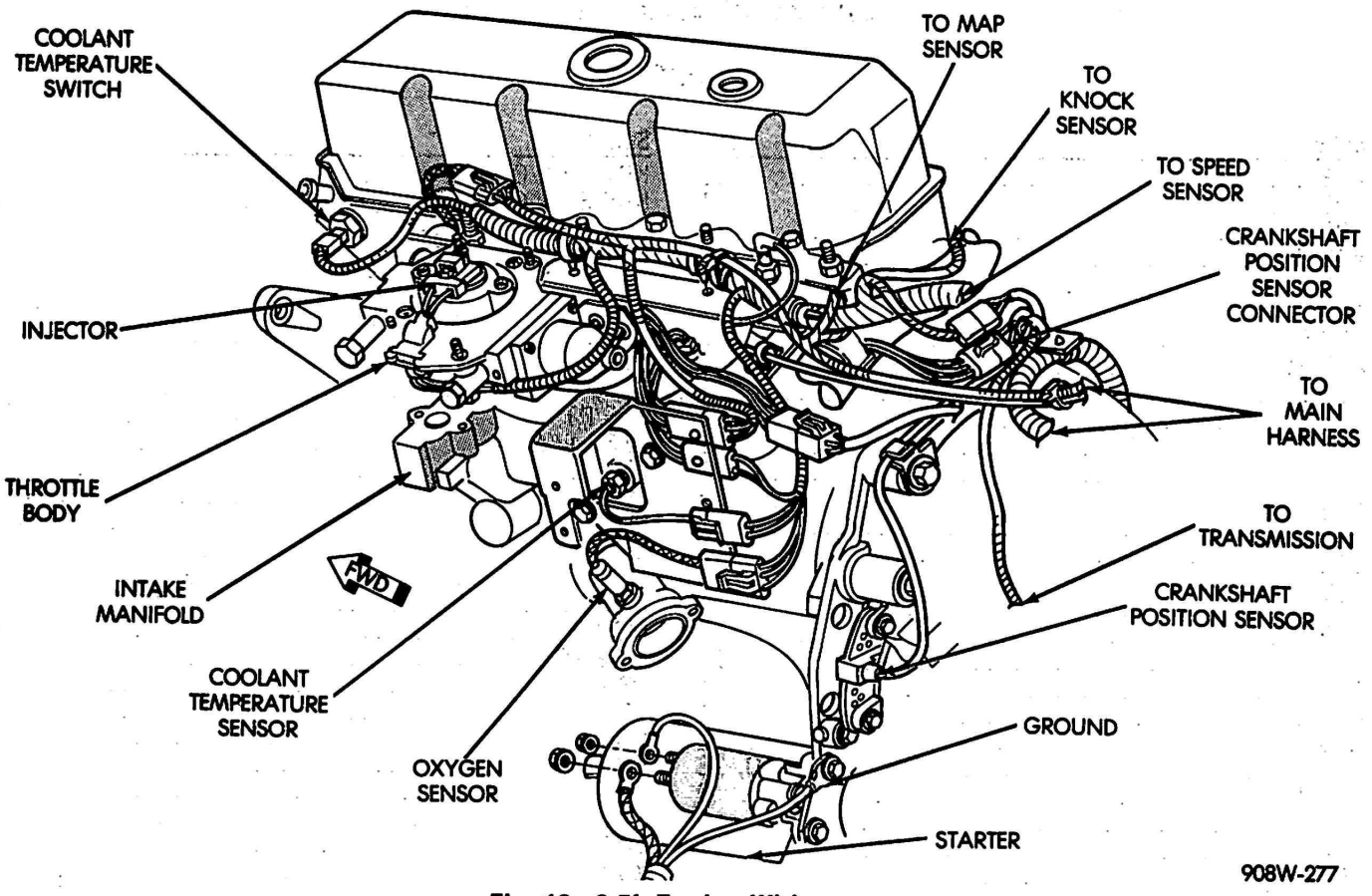


Fig. 18—2.5L Engine Wiring

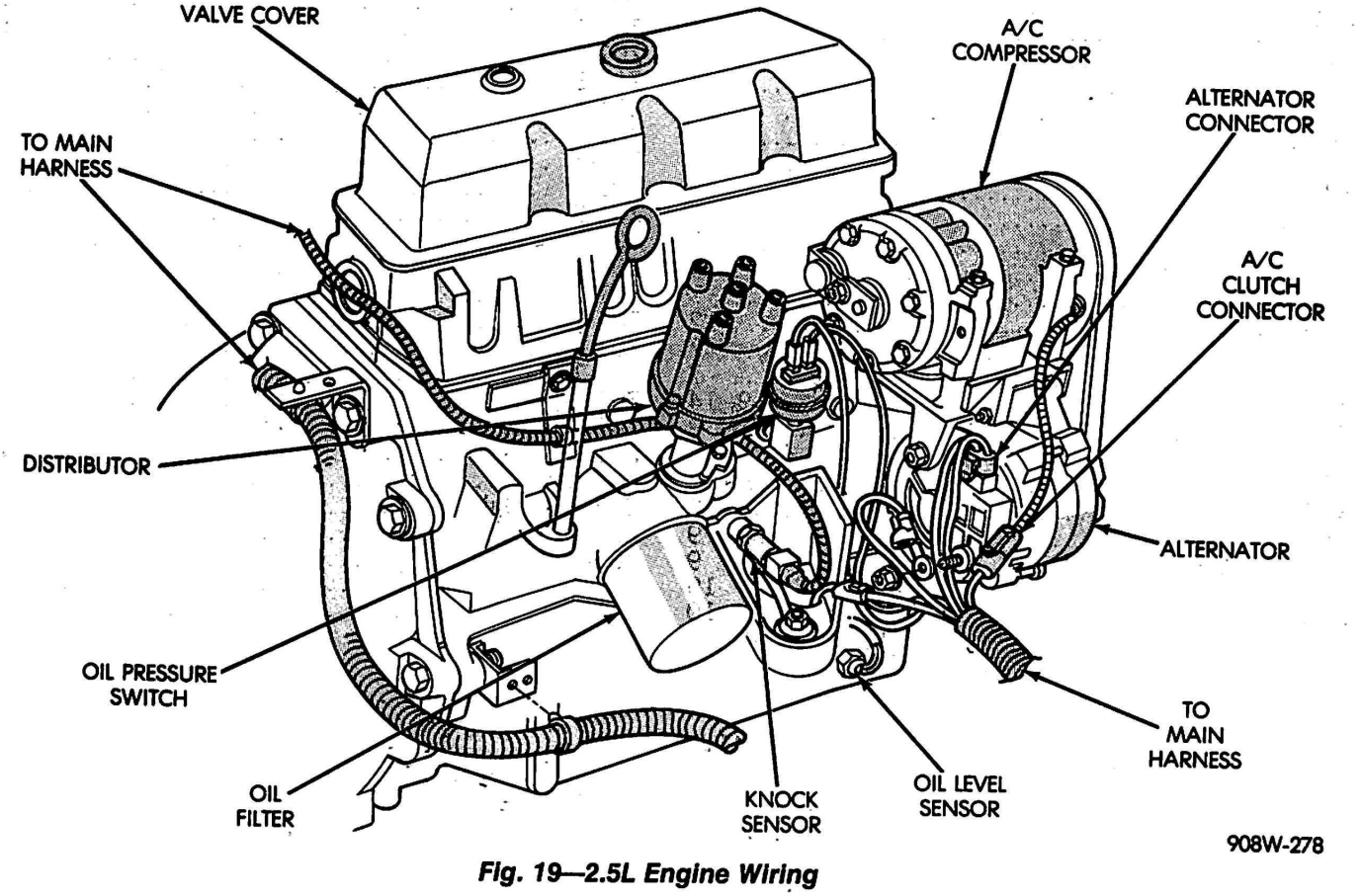
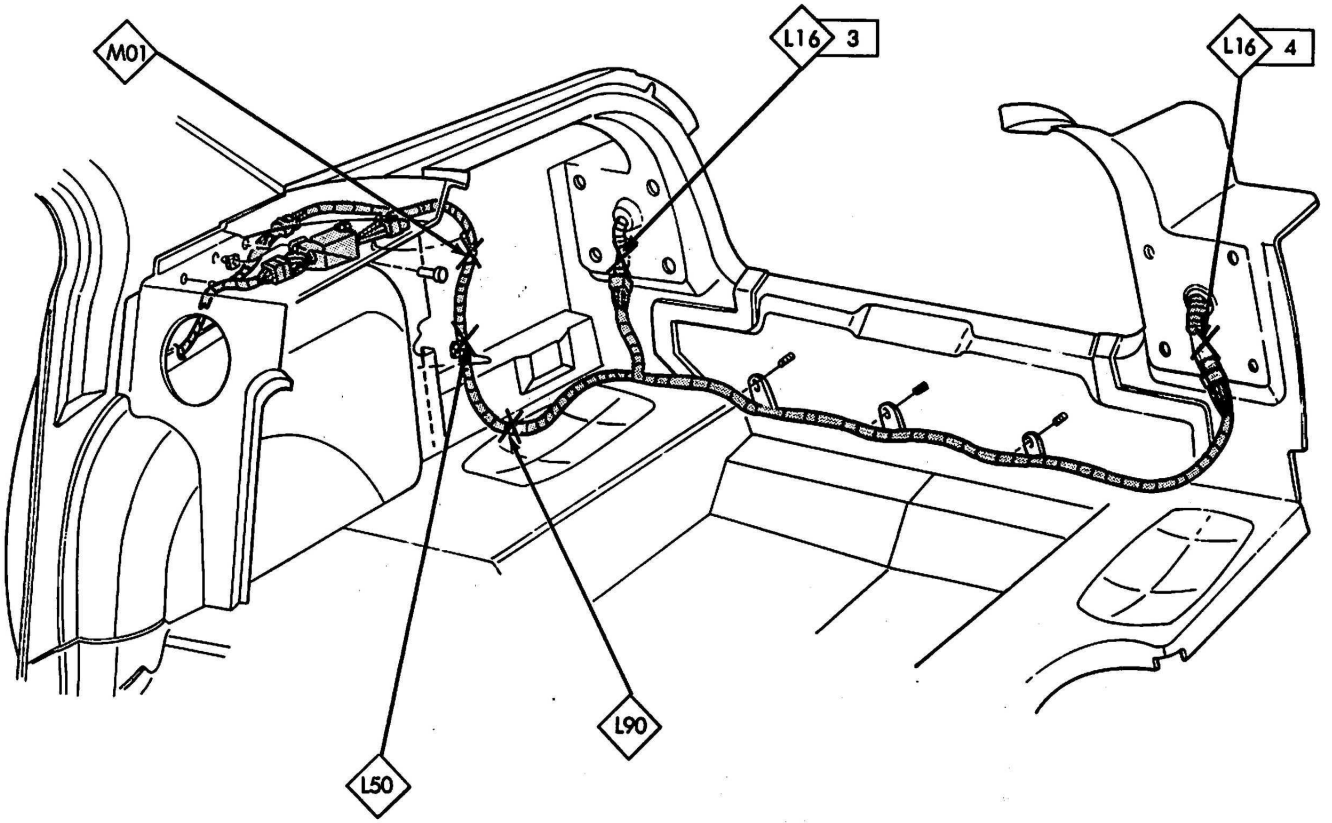


Fig. 19—2.5L Engine Wiring

SPLICE LOCATION

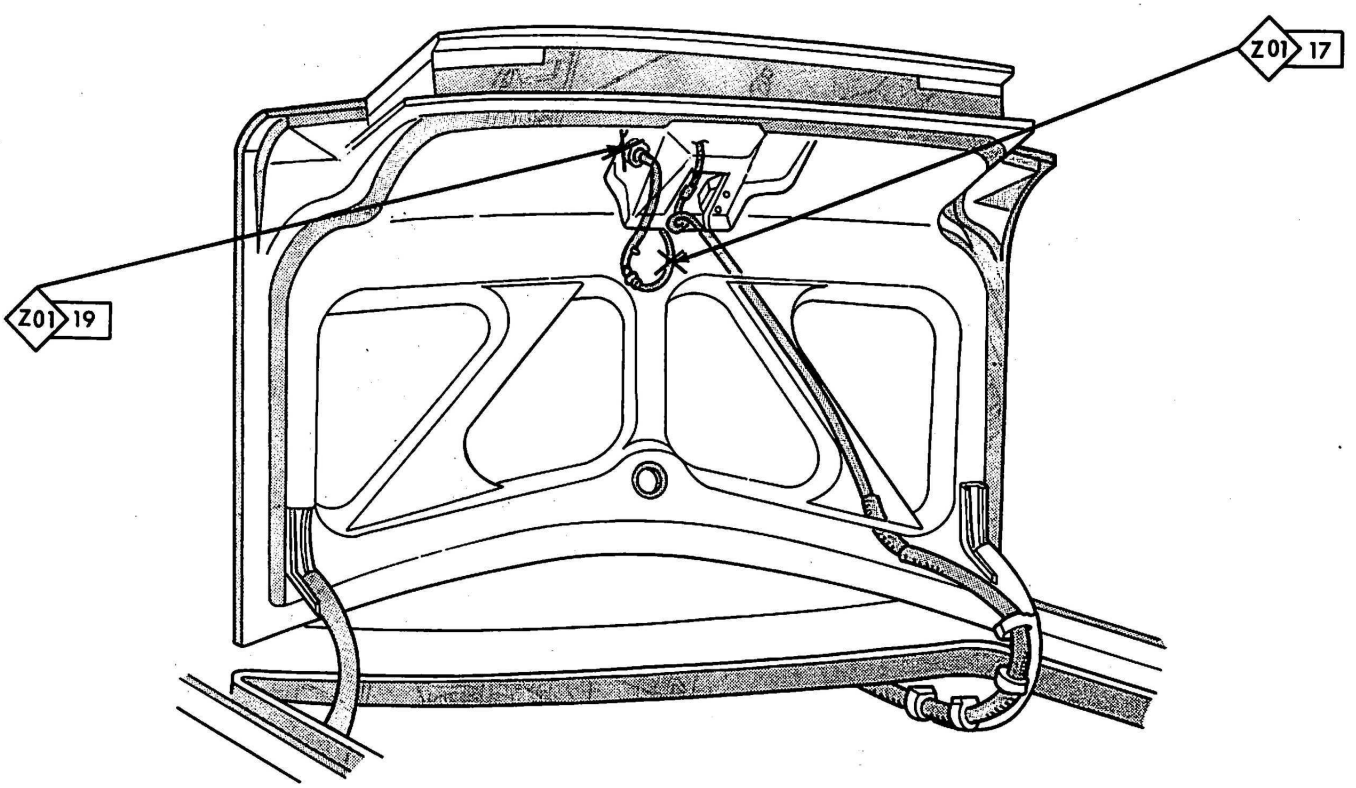
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Fig. 1—Rear End Splices



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Fig. 2—Deck Lid Splices

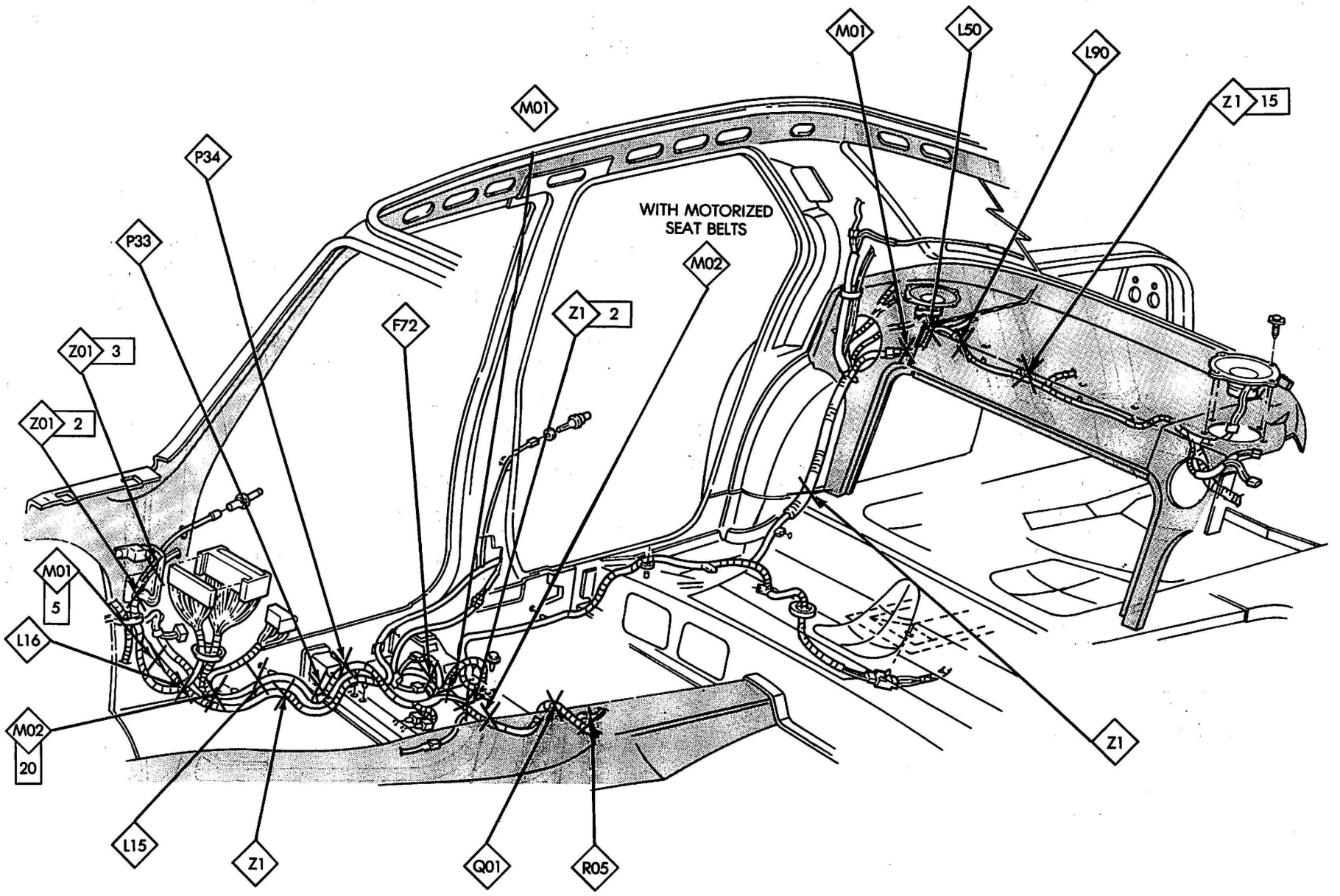


Fig. 3—Right Side Body Splices

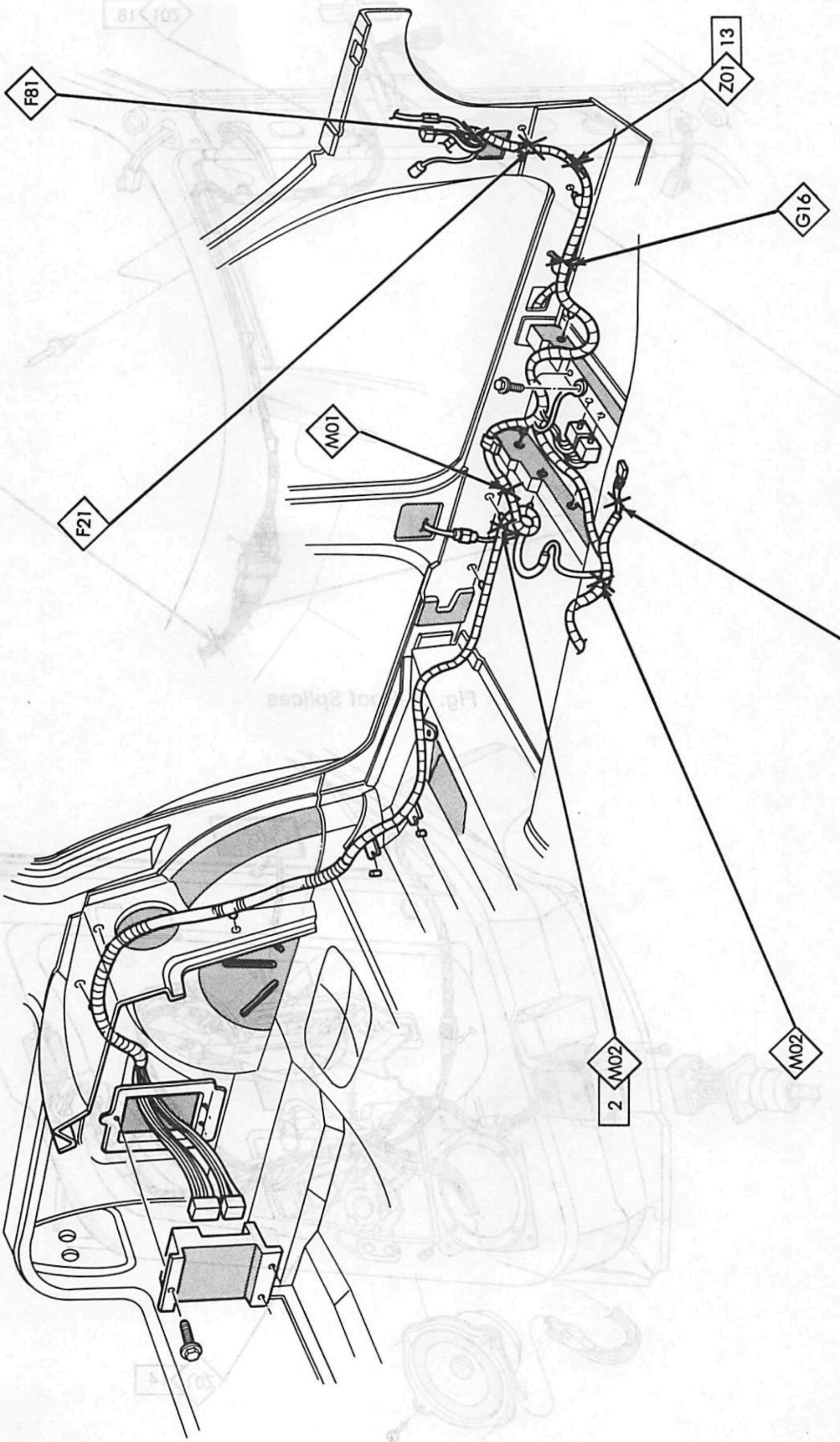


Fig. 4—Left Side Body Splices

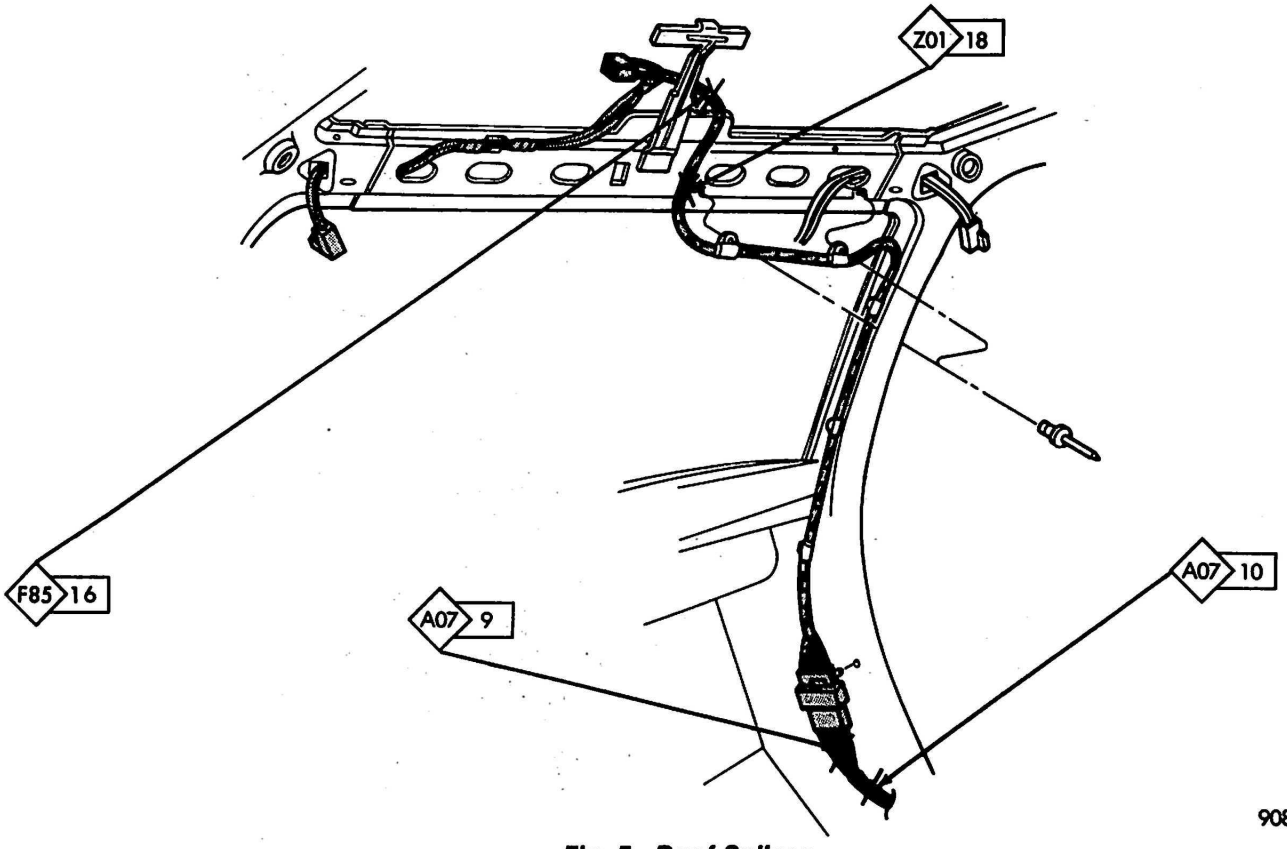


Fig. 5—Roof Splices

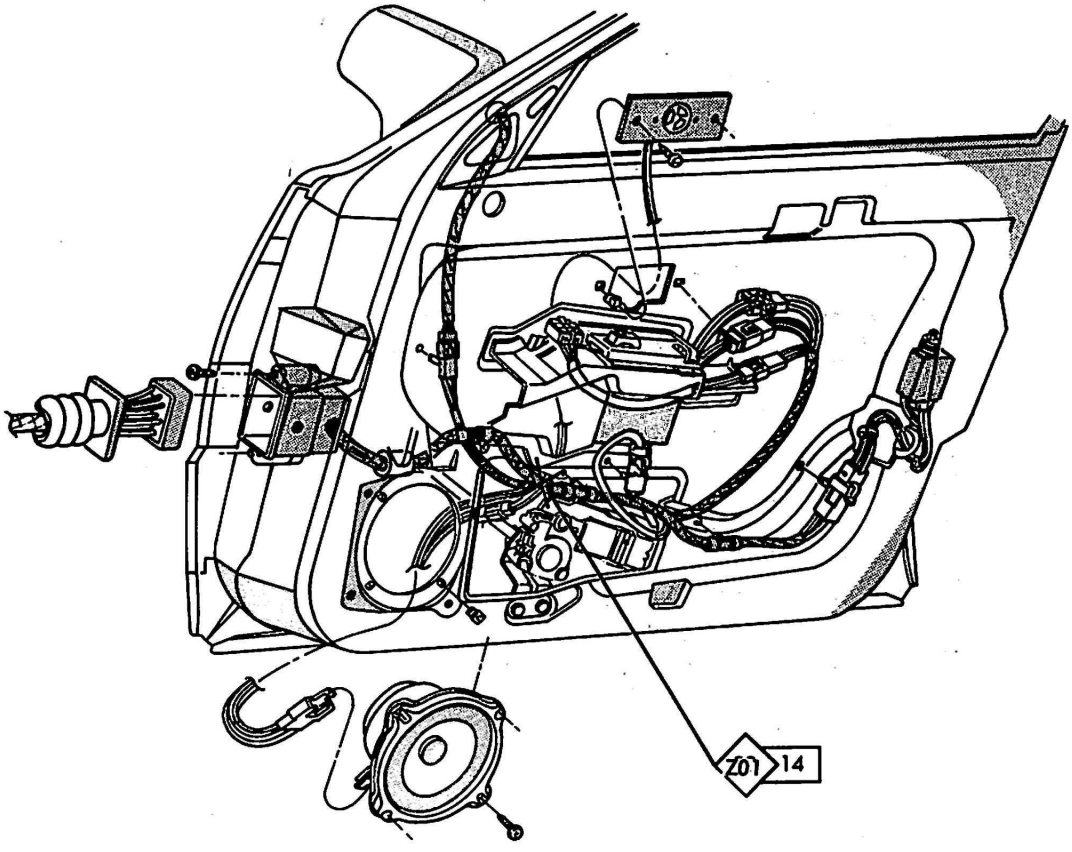


Fig. 6—Door Splices

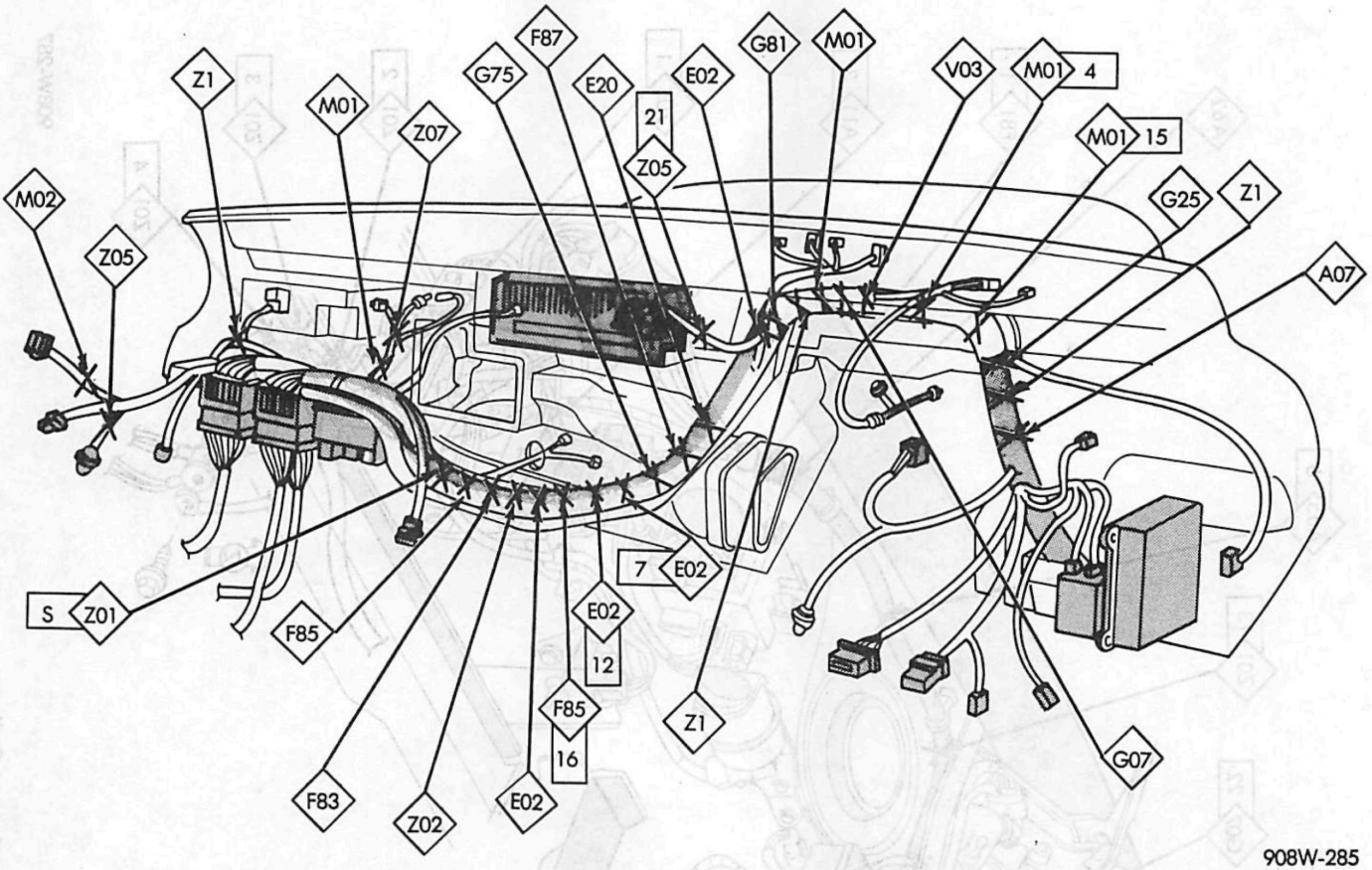


Fig. 7—Instrument Panel Splices

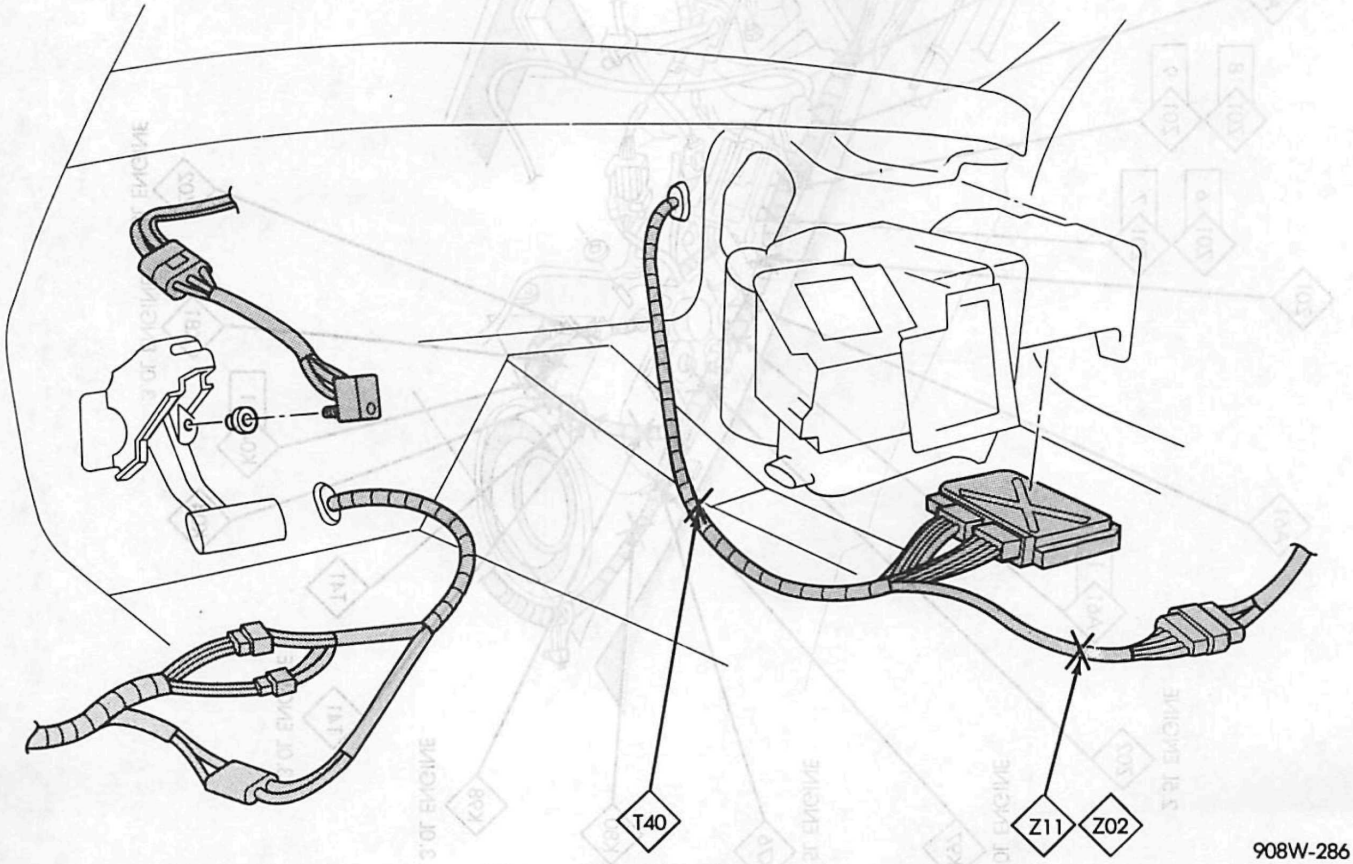


Fig. 8—Cowl Panel Splices

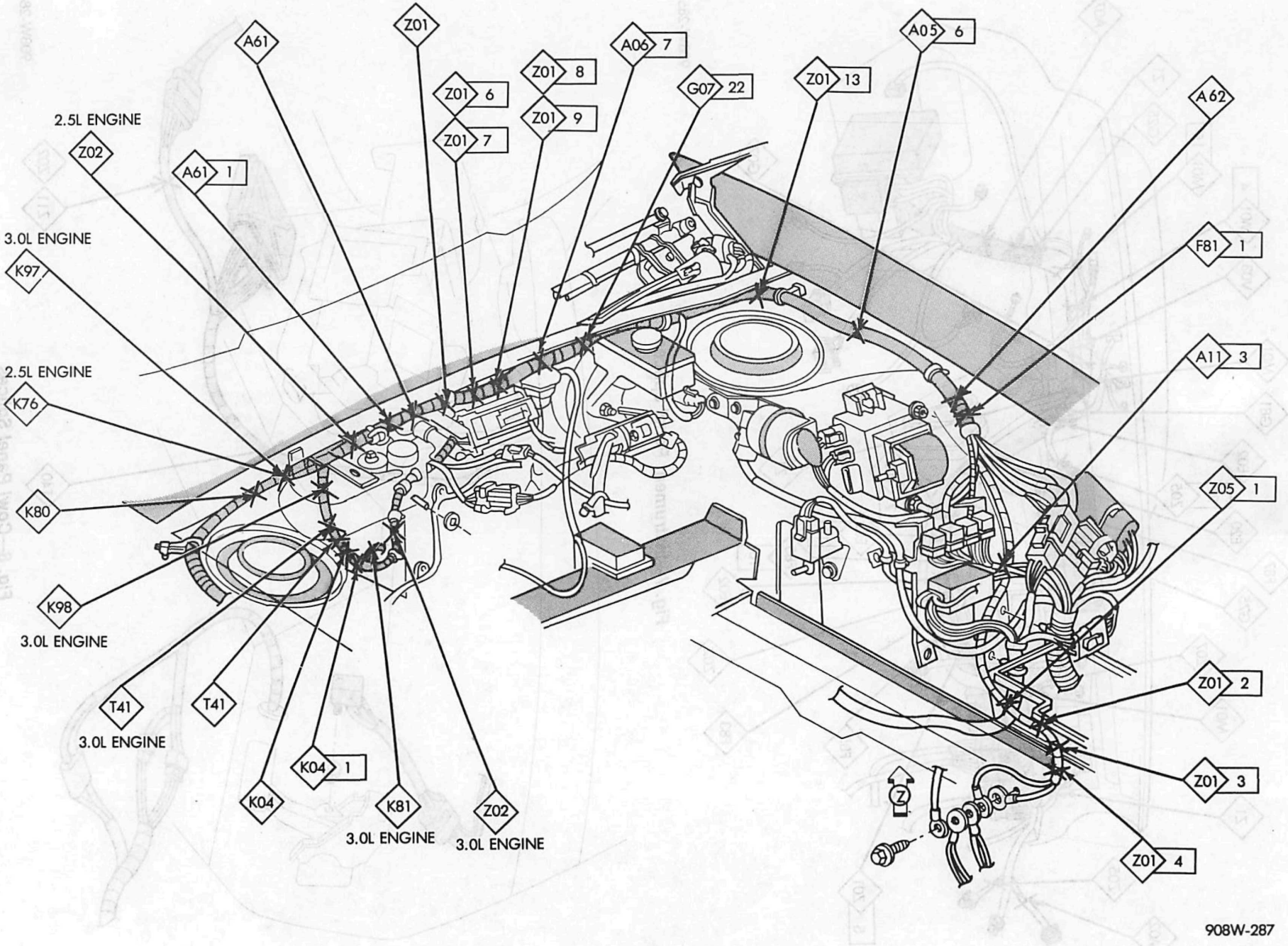


Fig. 9—Engine Compartment Splices

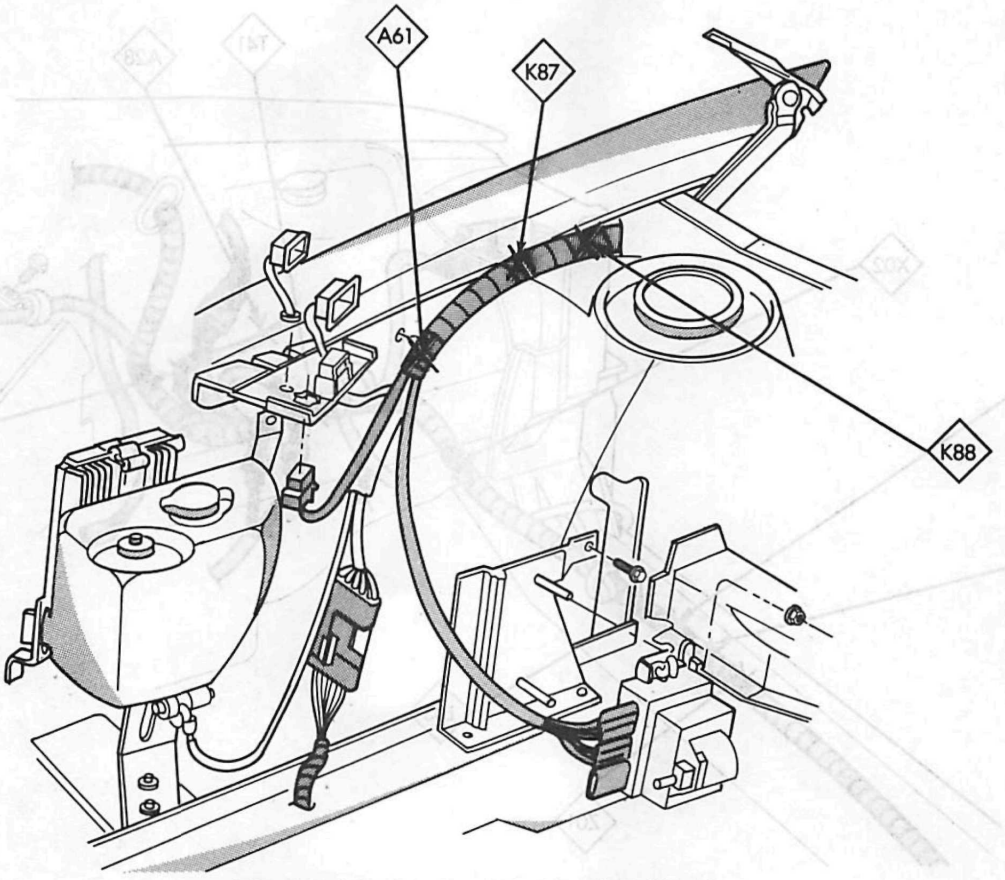


Fig. 10—Engine Compartment Splices

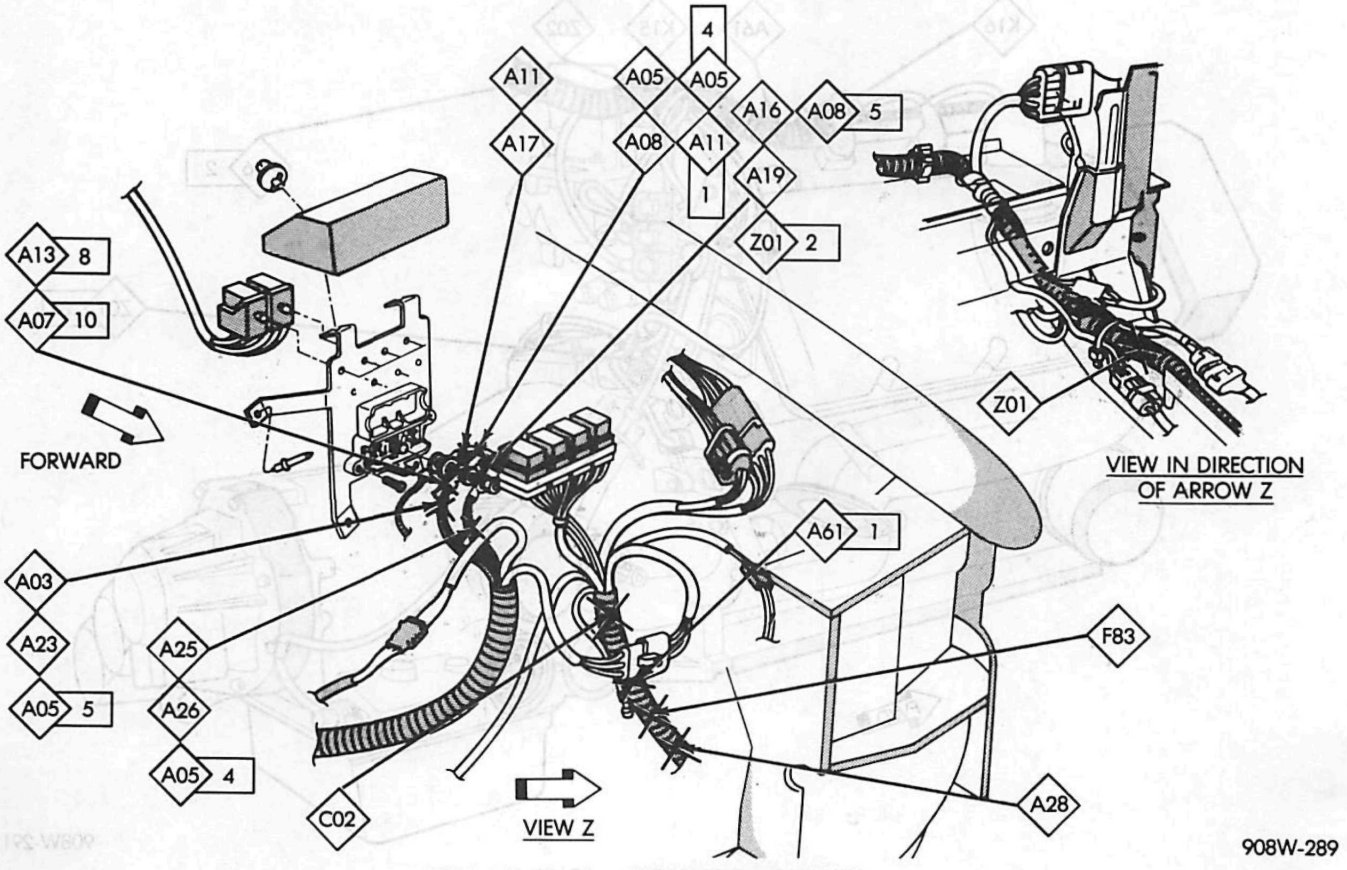


Fig. 11—Engine Compartment Splices

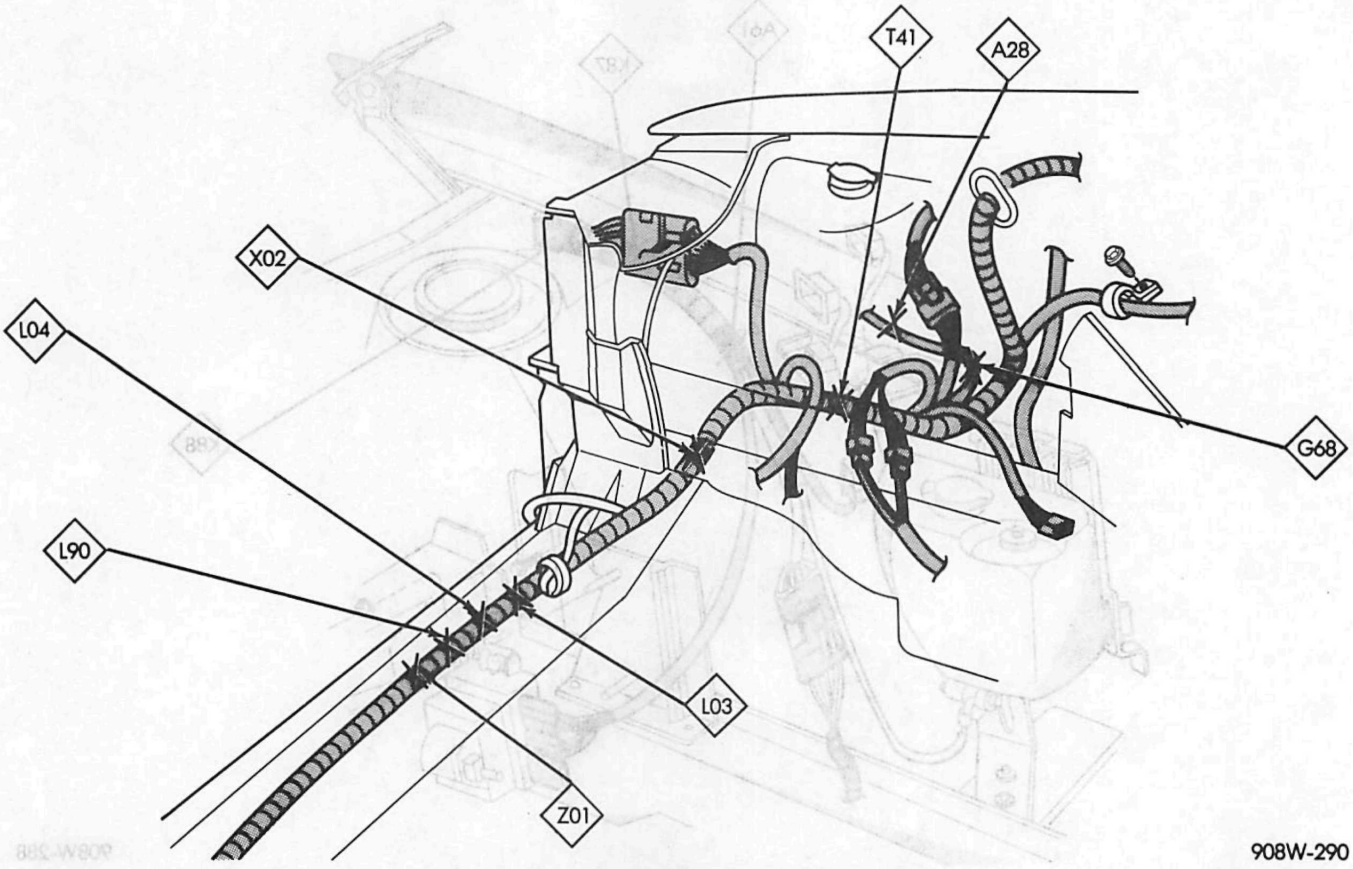


Fig. 12—Engine Compartment Splices

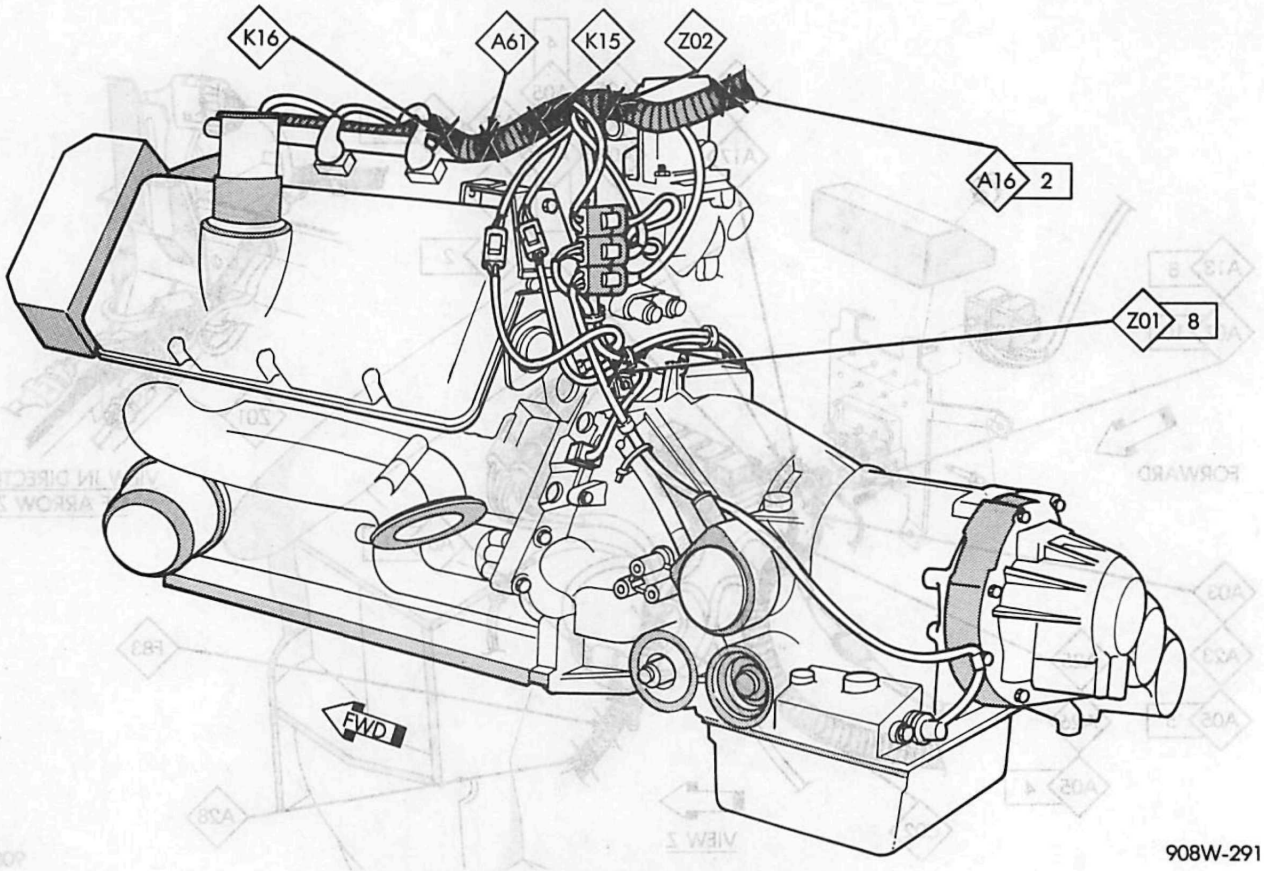


Fig. 13—3.0L Injector Splices

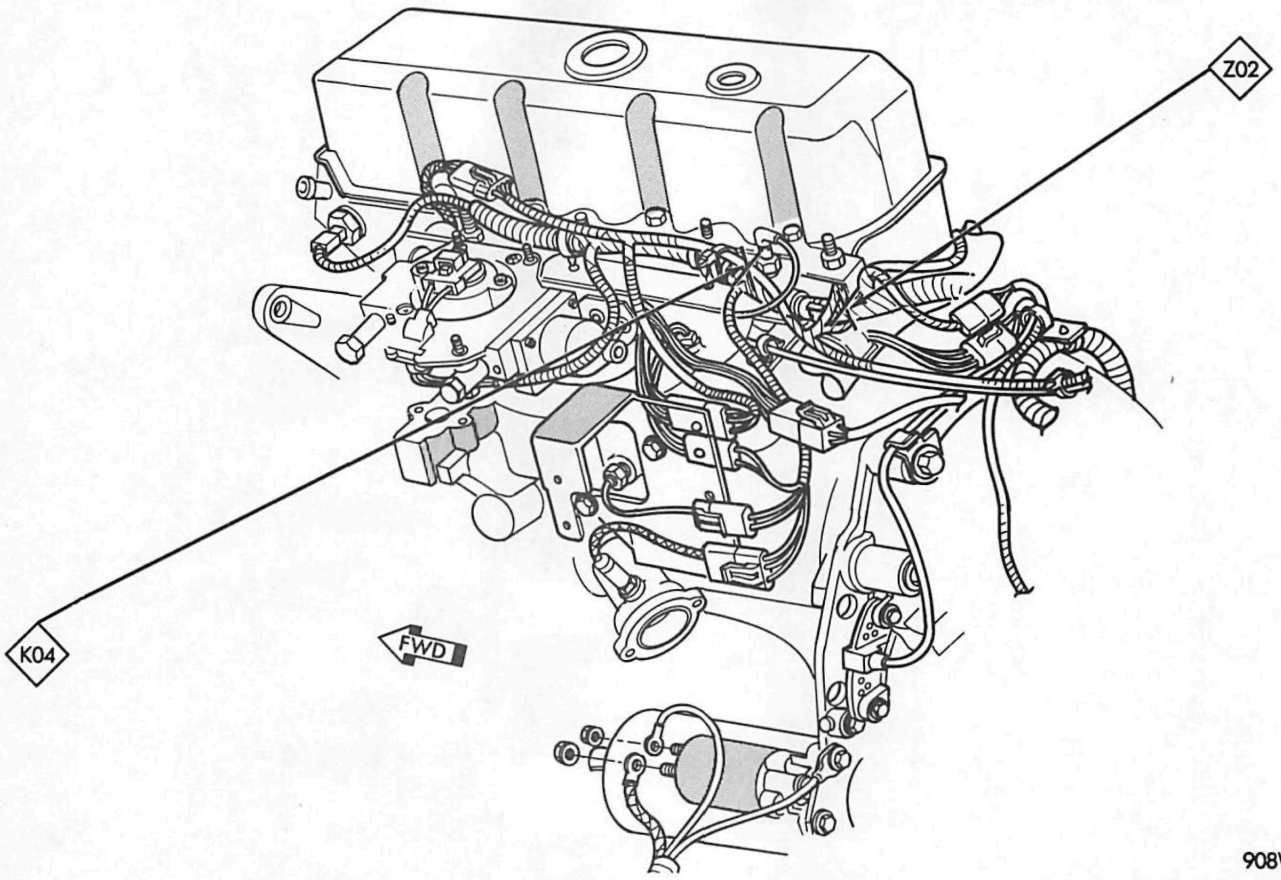


Fig. 14—2.5L Engine Splices

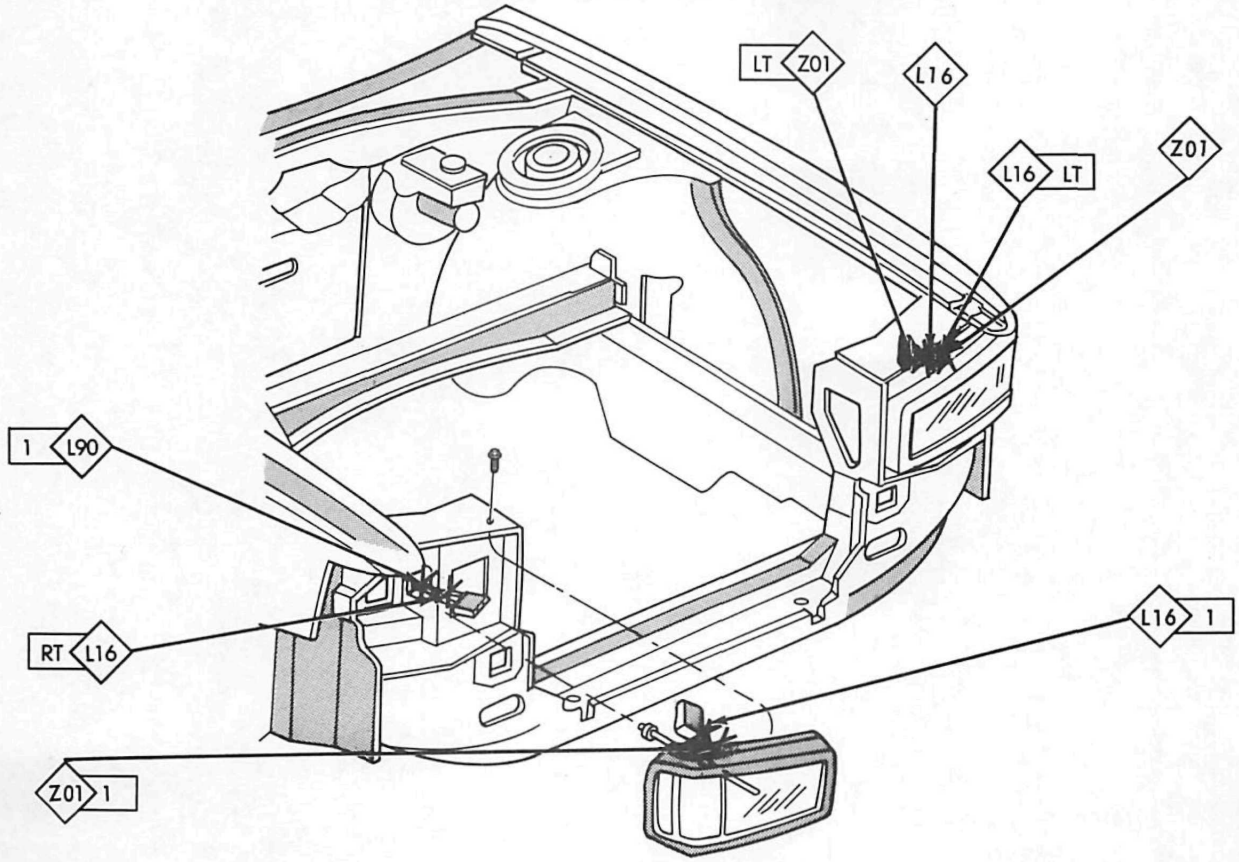


Fig. 15—Headlamp Splices

WIRE ROUTING AND COMPONENT LOCATION
ELECTRICAL WIRING DIAGRAMS BB BODY

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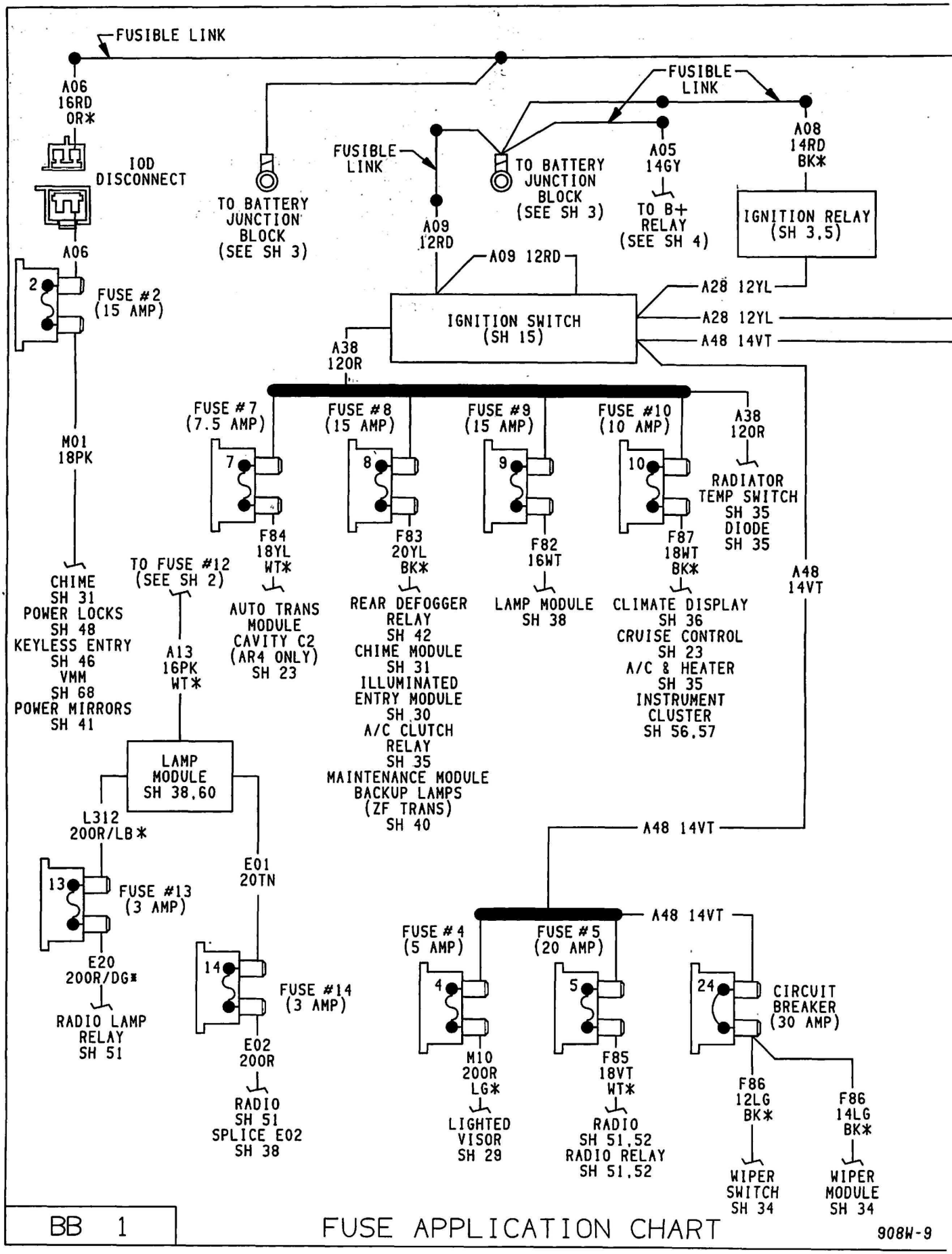
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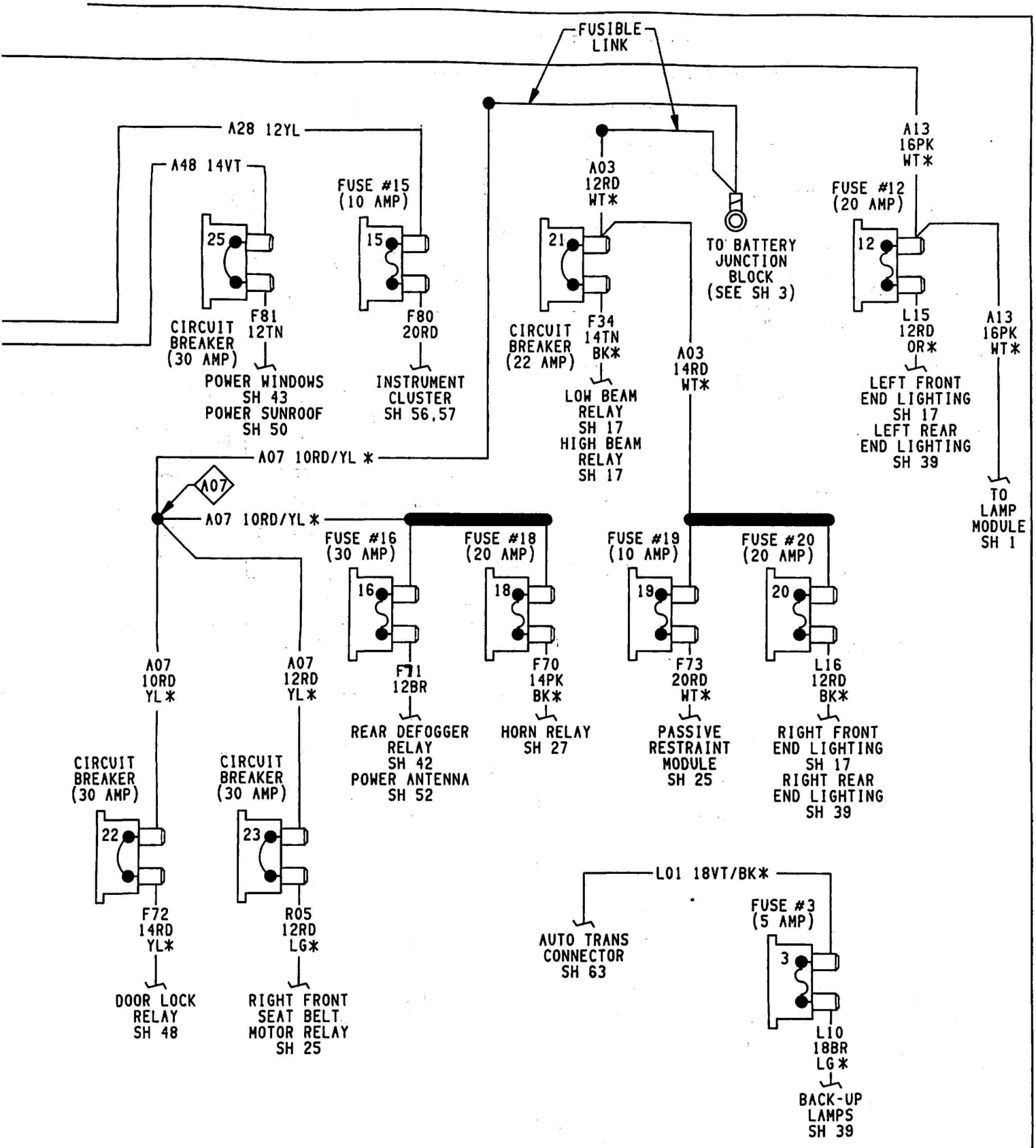
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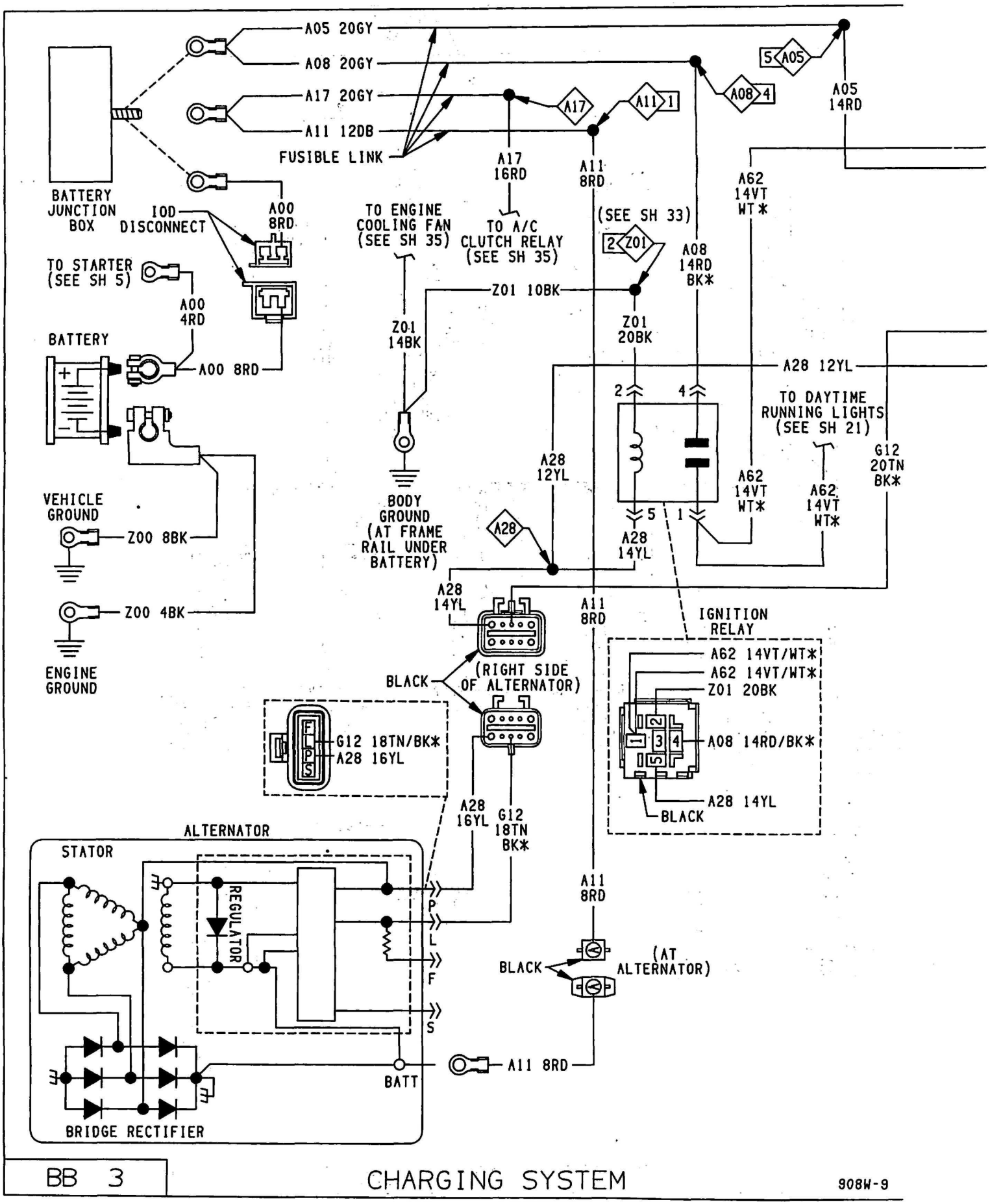
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A/C Clutch	35
A/C Low Pressure	35
Back-up Lamp	40
Blower A/C Heater	35
Blower Heater	35
Brake Switch	24
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Clutch A/C Cut-Out	35
Courtesy Lamp	30
Door Jamb	30
Electronic Speed Control	23
Engine Temp.	16
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Radiator Temp.	35
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Retractor	25
Speed Control	23
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Trunk Lamp	32
Trunk Lock	32
Temp Sensor Exterior Cluster	28
Throttle Position Sensor	
E.F.I. 6 cyl.	11
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ZF Trans Circuits	63
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Cavity B	2, 40
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Cavity F	6, 14, 24
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Cavity B6	9, 13
Cavity C1	4, 6
Cavity C2	1, 23
Cavity C3	5, 23

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Cavity 2	33
Cavity 3	37
Cavity 4	16
Cavity 5	36
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Cavity 7	48
Cavity 8	48
Cavity 9	48
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Cavity 12	39
Cavity 13	39
Cavity 14	31
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Cavity 16	51
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Control Unit	33
Low-Washer Fluid Lamp	33
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Module	34
Washer Pump Motor	33
Washer Switch	34
Wiper Motor	33
Wiper Switch	34

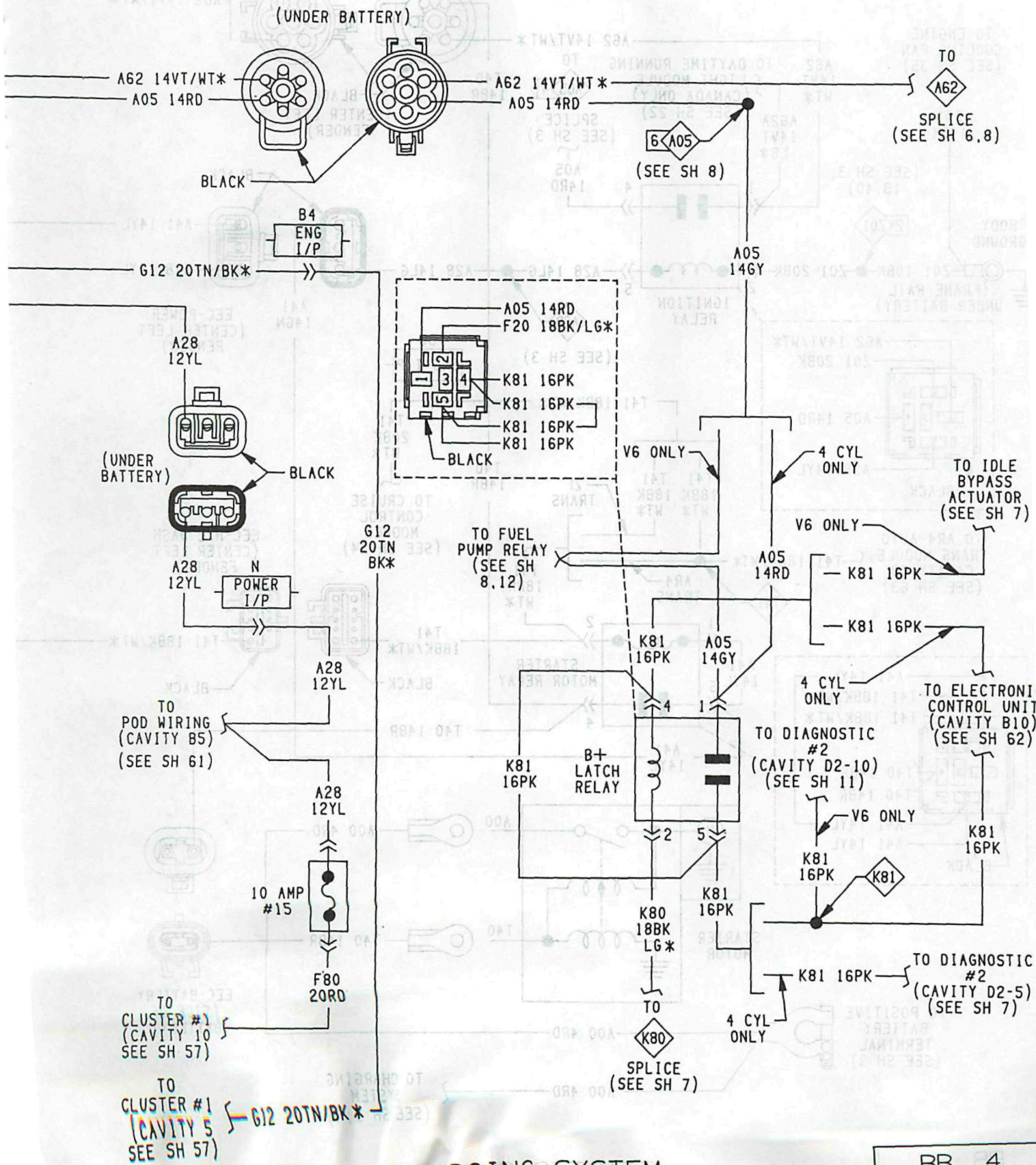

FUSIBLE LINK
A06
16RD
OR*
IOD
DISCONNECT
A06
2
FUSE #2
(15 AMP)
M01
18PK
CHIME
SH 31
POWER LOCKS
SH 48
KEYLESS ENTRY
SH 46
VMM
SH 68
POWER MIRRORS
SH 41
TO BATTERY
JUNCTION
BLOCK
(SEE SH 3)
FUSIBLE
LINK
A09
12RD
TO BATTERY
JUNCTION
BLOCK
(SEE SH 3)
FUSIBLE
LINK
A05
14GY
TO B+
RELAY
(SEE SH 4)
A08
14RD
BK*
IGNITION RELAY
(SH 3,5)
A09 12RD
A28 12YL
IGNITION SWITCH
(SH 15)
A28 12YL
A48 14VT
A38
120R
FUSE #7
(7.5 AMP)
FUSE #8
(15 AMP)
FUSE #9
(15 AMP)
FUSE #10
(10 AMP)
A38
120R
7
8
9
10
F84
18YL
WT*
F83
20YL
BK*
F82
16WT
F87
18WT
BK*
RADIATOR
TEMP SWITCH
SH 35
DIODE
SH 35
A48
14VT
TO FUSE #12
(SEE SH 2)
A13
16PK
WT*
AUTO TRANS
MODULE
CAVITY C2
(AR4 ONLY)
SH 23
REAR DEFOGGER
RELAY
SH 42
CHIME MODULE
SH 31
ILLUMINATED
ENTRY MODULE
SH 30
A/C CLUTCH
RELAY
SH 35
MAINTENANCE MODULE
BACKUP LAMPS
(ZF TRANS)
SH 40
LAMP MODULE
SH 38
CLIMATE DISPLAY
SH 36
CRUISE CONTROL
SH 23
A/C & HEATER
SH 35
INSTRUMENT
CLUSTER
SH 56,57
LAMP
MODULE
SH 38,60
L312
200R/LB*
13
FUSE #13
(3 AMP)
E20
200R/DG*
RADIO LAMP
RELAY
SH 51
E01
20TN
14
FUSE #14
(3 AMP)
E02
200R
RADIO
SH 51
SPLICE E02
SH 38
A48 14VT
A48 14VT
FUSE #4
(5 AMP)
FUSE #5
(20 AMP)
4
5
24
M10
200R
LG*
LIGHTED
VISOR
SH 29
F85
18VT
WT*
RADIO
SH 51,52
RADIO RELAY
SH 51,52
CIRCUIT
BREAKER
(30 AMP)
F86
12LG
BK*
F86
14LG
BK*
WIPER
SWITCH
SH 34
WIPER
MODULE
SH 34
BB 1
FUSE APPLICATION CHART
908W-9



908W-9 FUSE APPLICATION CHART BB 2

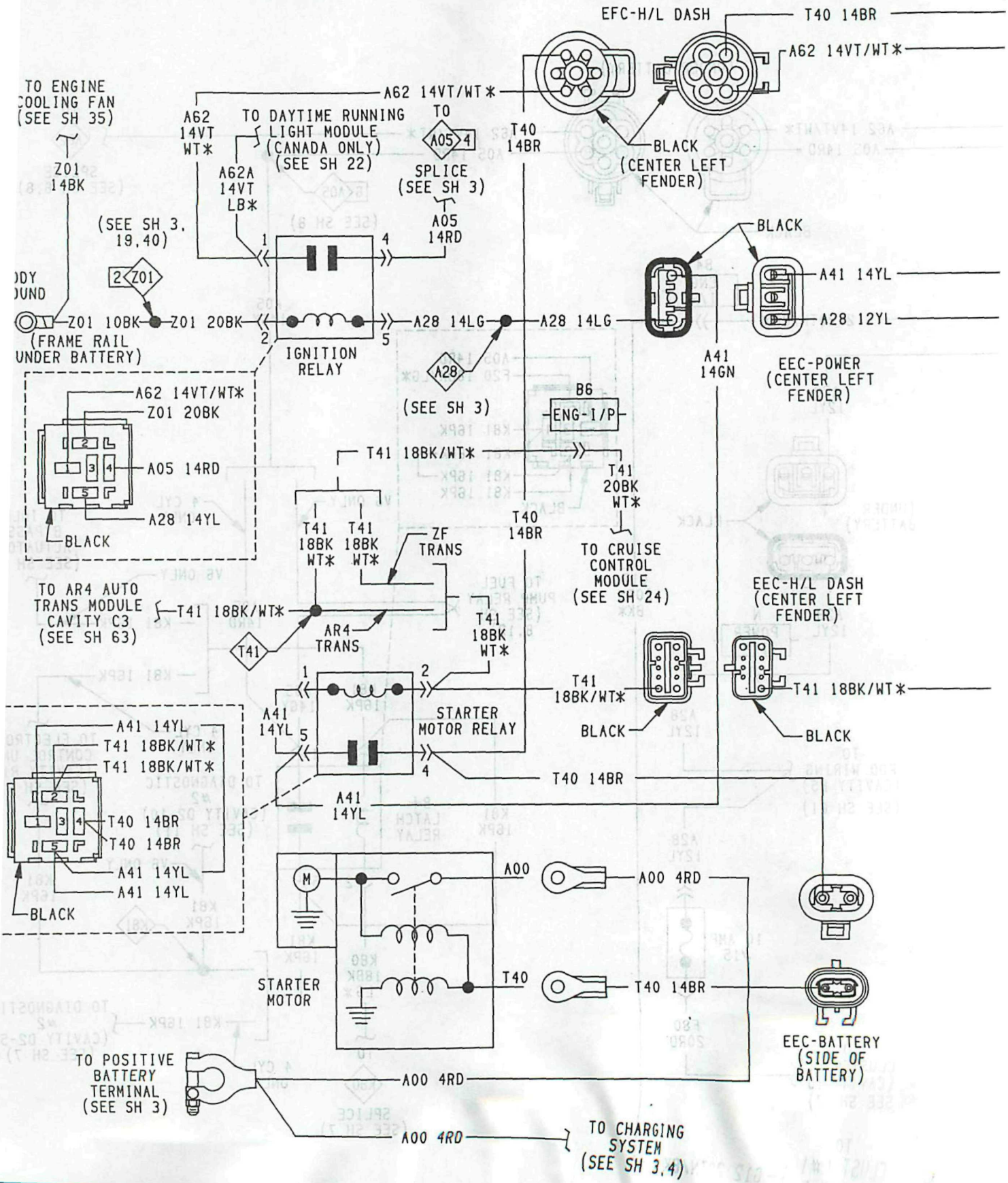


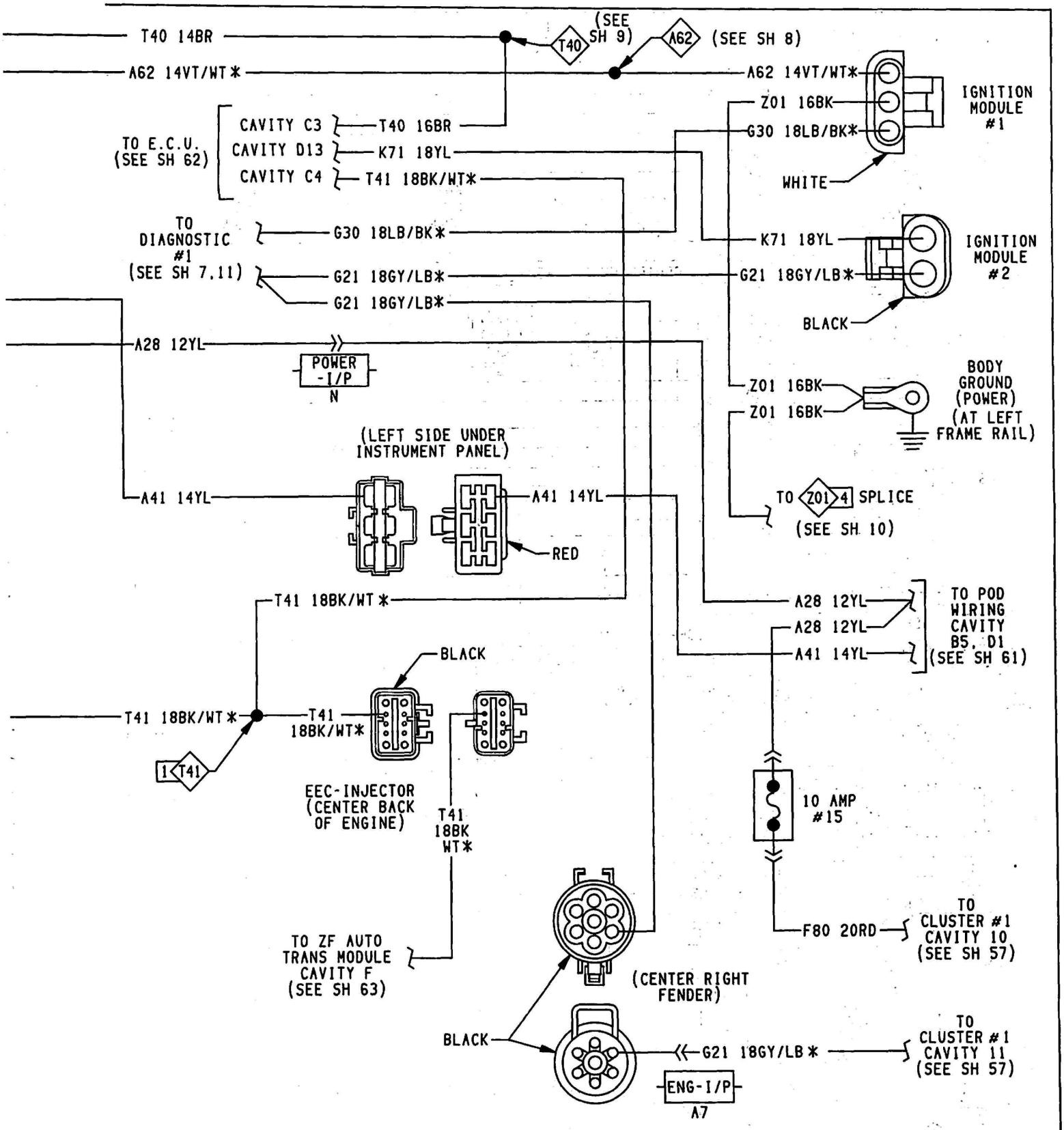
BB 3 CHARGING SYSTEM 908W-9

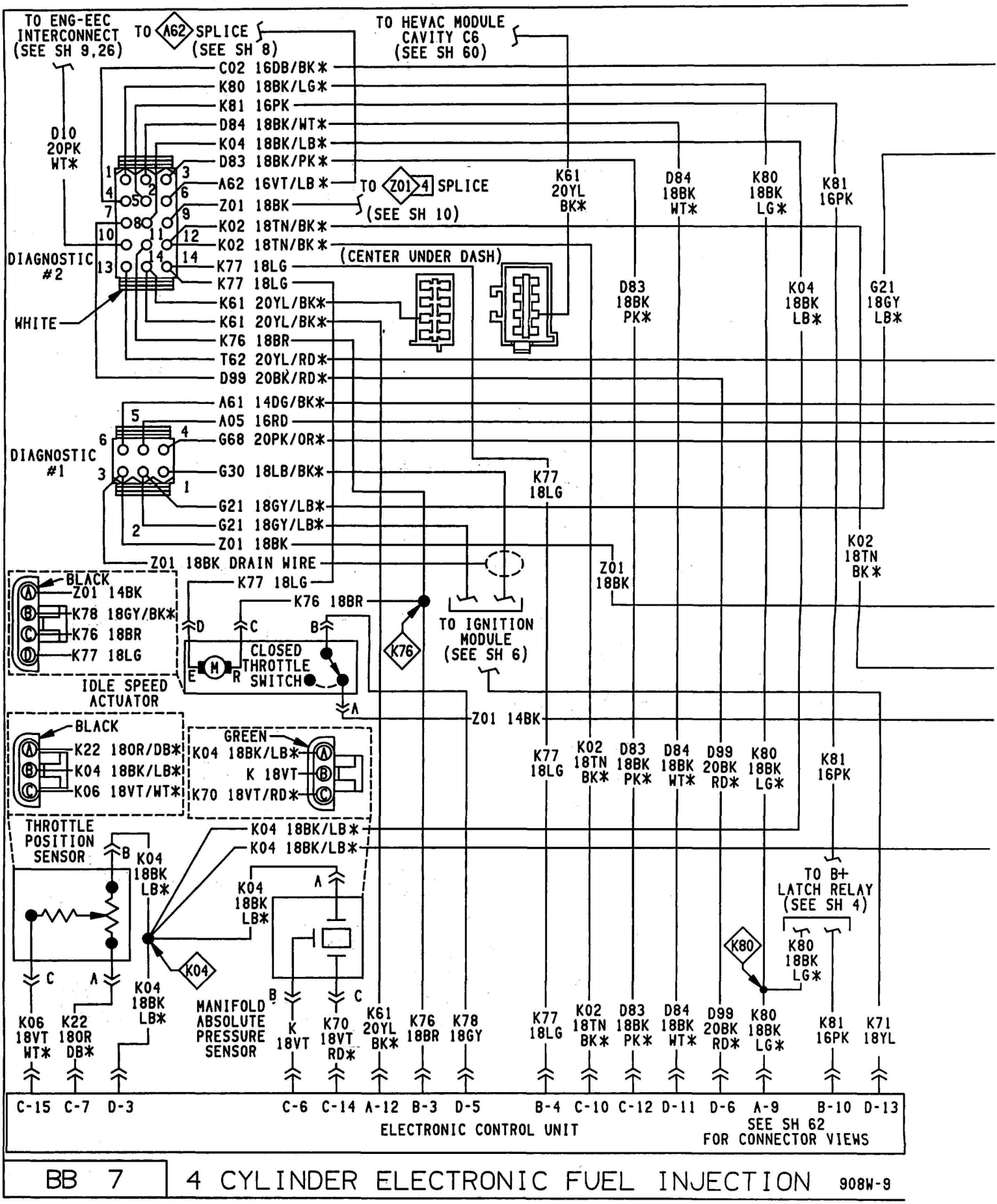


CHARGING SYSTEM

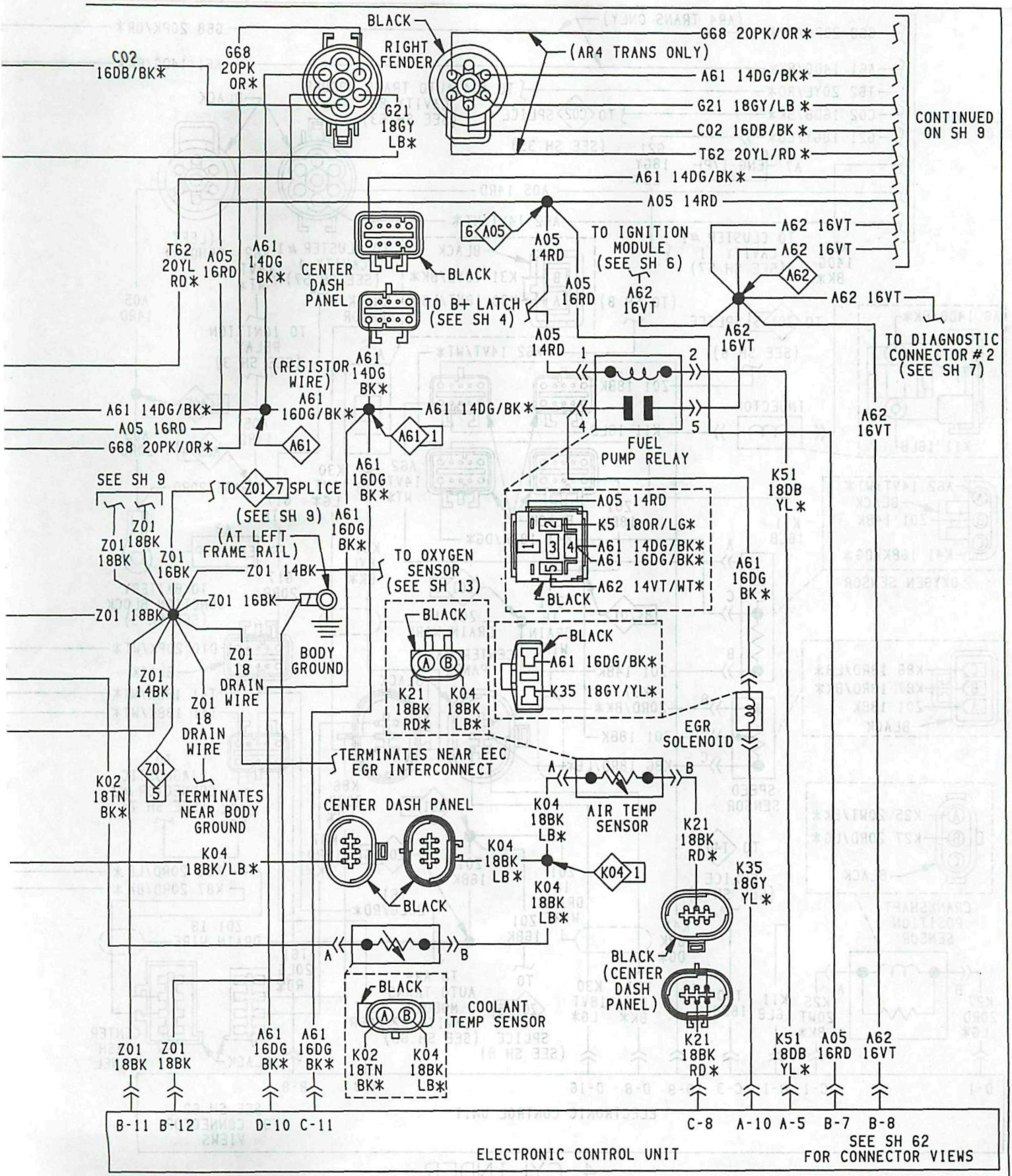
BB 4


EFC-H/L DASH
T40 14BR
A62 14VT/WT*
TO ENGINE COOLING FAN (SEE SH 35)
A62 14VT/WT*
A62 14VT WT*
TO DAYTIME RUNNING LIGHT MODULE (CANADA ONLY) (SEE SH 22)
A62A 14VT LB*
TO
A05 4
SPLICE (SEE SH 3)
A05 14RD
T40 14BR
BLACK (CENTER LEFT FENDER)
Z01 14BK
(SEE SH 3, 19,40)
BLACK
A41 14YL
A28 12YL
Z01
Z01 10BK
Z01 20BK
A28 14LG
A28 14LG
(FRAME RAIL UNDER BATTERY)
IGNITION RELAY
A28
(SEE SH 3)
A41 14GN
EEC-POWER (CENTER LEFT FENDER)
B6
ENG-I/P
A62 14VT/WT*
Z01 20BK
A05 14RD
A28 14YL
BLACK
T41 18BK/WT*
T41 20BK WT*
T41 18BK WT*
T41 18BK WT*
ZF TRANS
T40 14BR
TO CRUISE CONTROL MODULE (SEE SH 24)
TO AR4 AUTO TRANS MODULE CAVITY C3 (SEE SH 63)
T41 18BK/WT*
AR4 TRANS
T41
T41 18BK WT*
EEC-H/L DASH (CENTER LEFT FENDER)
T41 18BK/WT*
T41 18BK/WT*
BLACK
BLACK
A41 14YL
STARTER MOTOR RELAY
A41 14YL
T40 14BR
A41 14YL
T41 18BK/WT*
T41 18BK/WT*
T40 14BR
T40 14BR
A41 14YL
A41 14YL
BLACK
A00
A00 4RD
STARTER MOTOR
T40
T40 14BR
EEC-BATTERY (SIDE OF BATTERY)
TO POSITIVE BATTERY TERMINAL (SEE SH 3)
A00 4RD
A00 4RD
TO CHARGING SYSTEM (SEE SH 3,4)

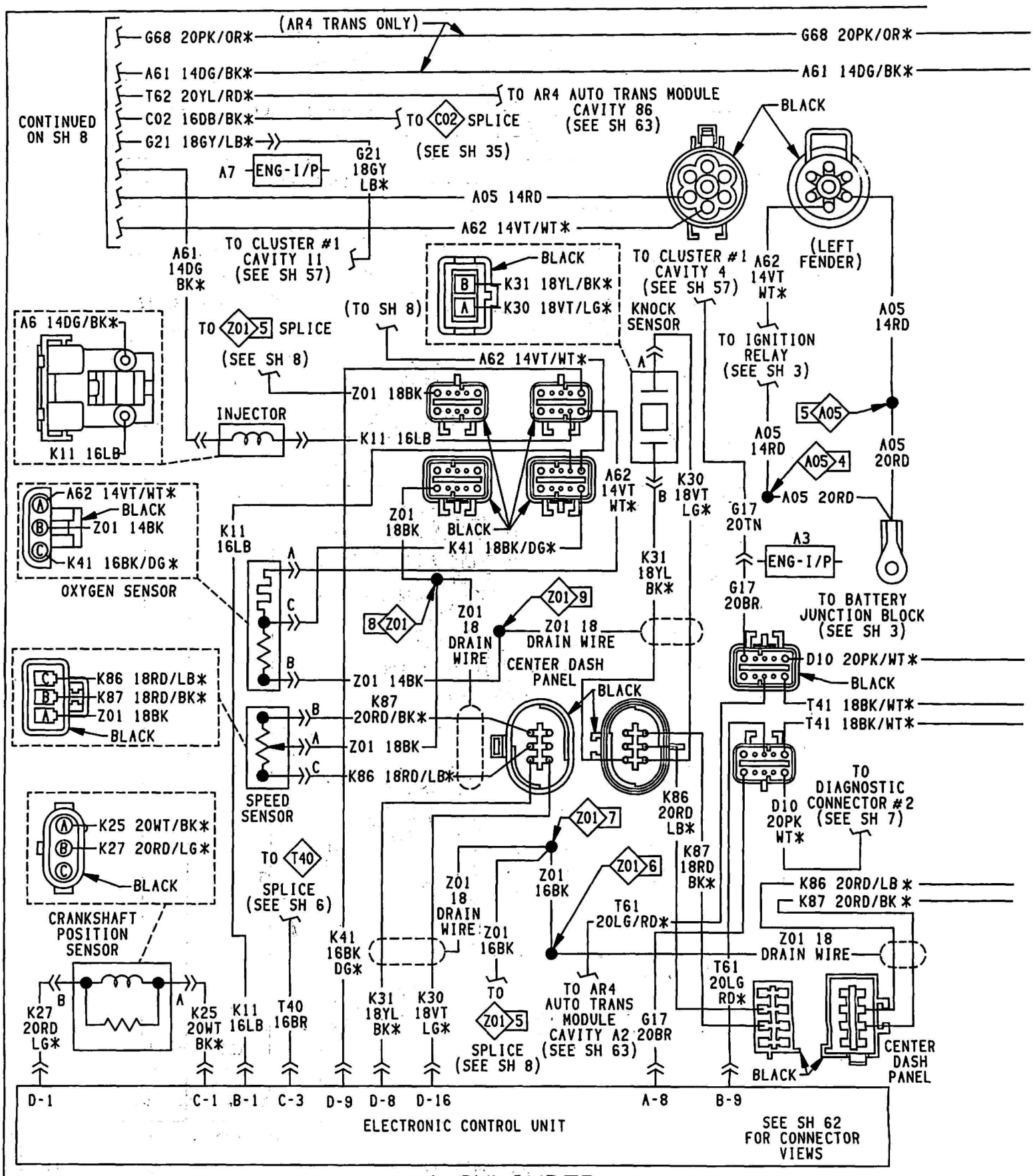

T40 14BR
A62 14VT/WT*
(SEE SH 9)
T40
A62
(SEE SH 8)
A62 14VT/WT*
IGNITION MODULE #1
Z01 16BK
G30 18LB/BK*
WHITE
TO E.C.U. (SEE SH 62)
CAVITY C3
CAVITY D13
CAVITY C4
T40 16BR
K71 18YL
T41 18BK/WT*
TO DIAGNOSTIC #1 (SEE SH 7.11)
G30 18LB/BK*
G21 18GY/LB*
G21 18GY/LB*
K71 18YL
IGNITION MODULE #2
G21 18GY/LB*
BLACK
A28 12YL
POWER -I/P N
Z01 16BK
Z01 16BK
BODY GROUND (POWER) (AT LEFT FRAME RAIL)
(LEFT SIDE UNDER INSTRUMENT PANEL)
A41 14YL
A41 14YL
RED
TO Z01 4 SPLICE (SEE SH 10)
T41 18BK/WT*
A28 12YL
A28 12YL
A41 14YL
TO POD WIRING CAVITY B5, D1 (SEE SH 61)
BLACK
T41 18BK/WT*
T41 18BK/WT*
1 T41
EEC-INJECTOR (CENTER BACK OF ENGINE)
T41 18BK WT*
10 AMP #15
F80 20RD
TO CLUSTER #1 CAVITY 10 (SEE SH 57)
TO ZF AUTO TRANS MODULE CAVITY F (SEE SH 63)
(CENTER RIGHT FENDER)
BLACK
G21 18GY/LB*
TO CLUSTER #1 CAVITY 11 (SEE SH 57)
ENG-I/P A7



BB 7 | 4 CYLINDER ELECTRONIC FUEL INJECTION 908W-9



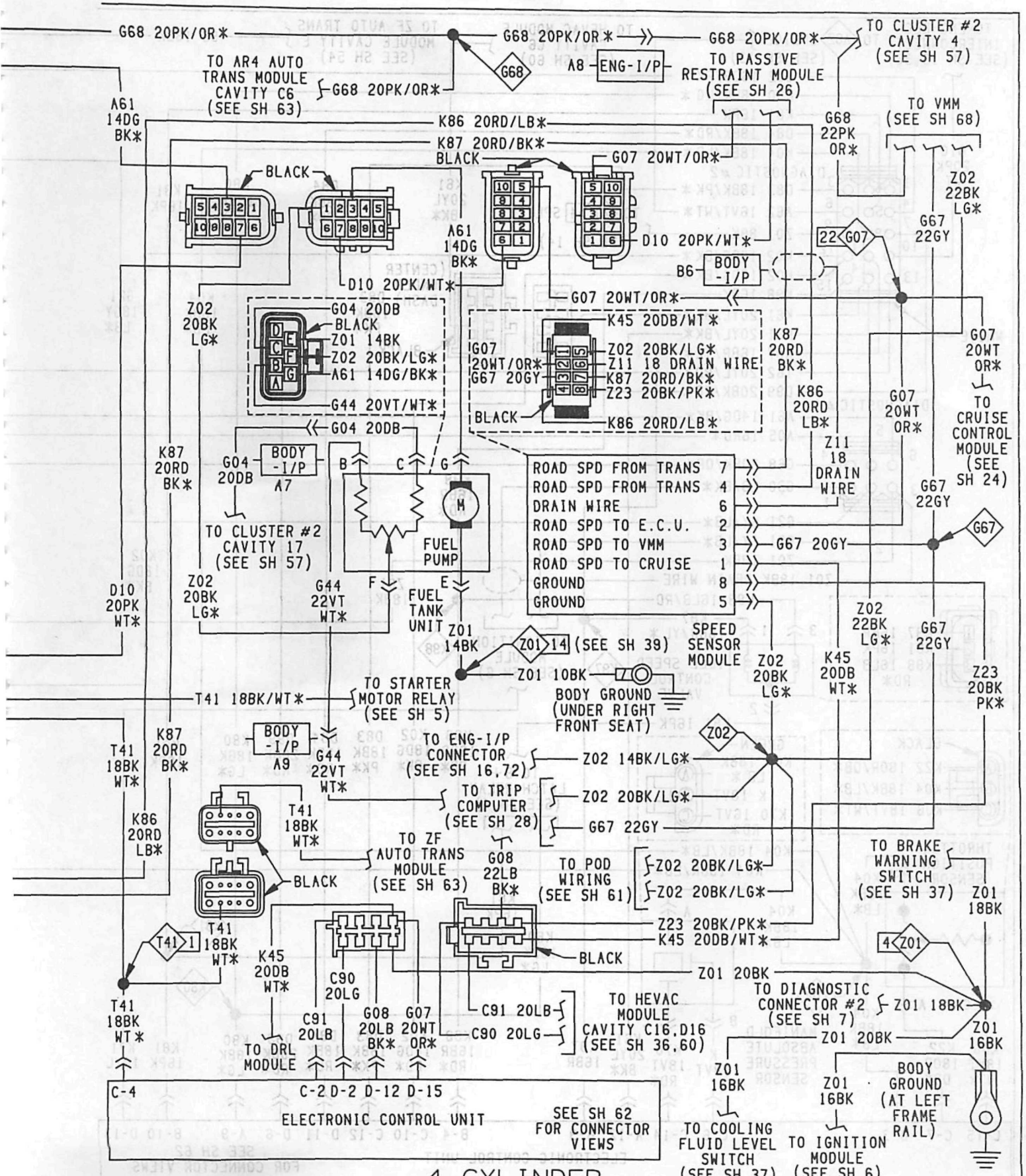
908W-9 4 CYLINDER ELECTRONIC FUEL INJECTION BB 8



4 CYLINDER ELECTRONIC FUEL INJECTION

BB 9

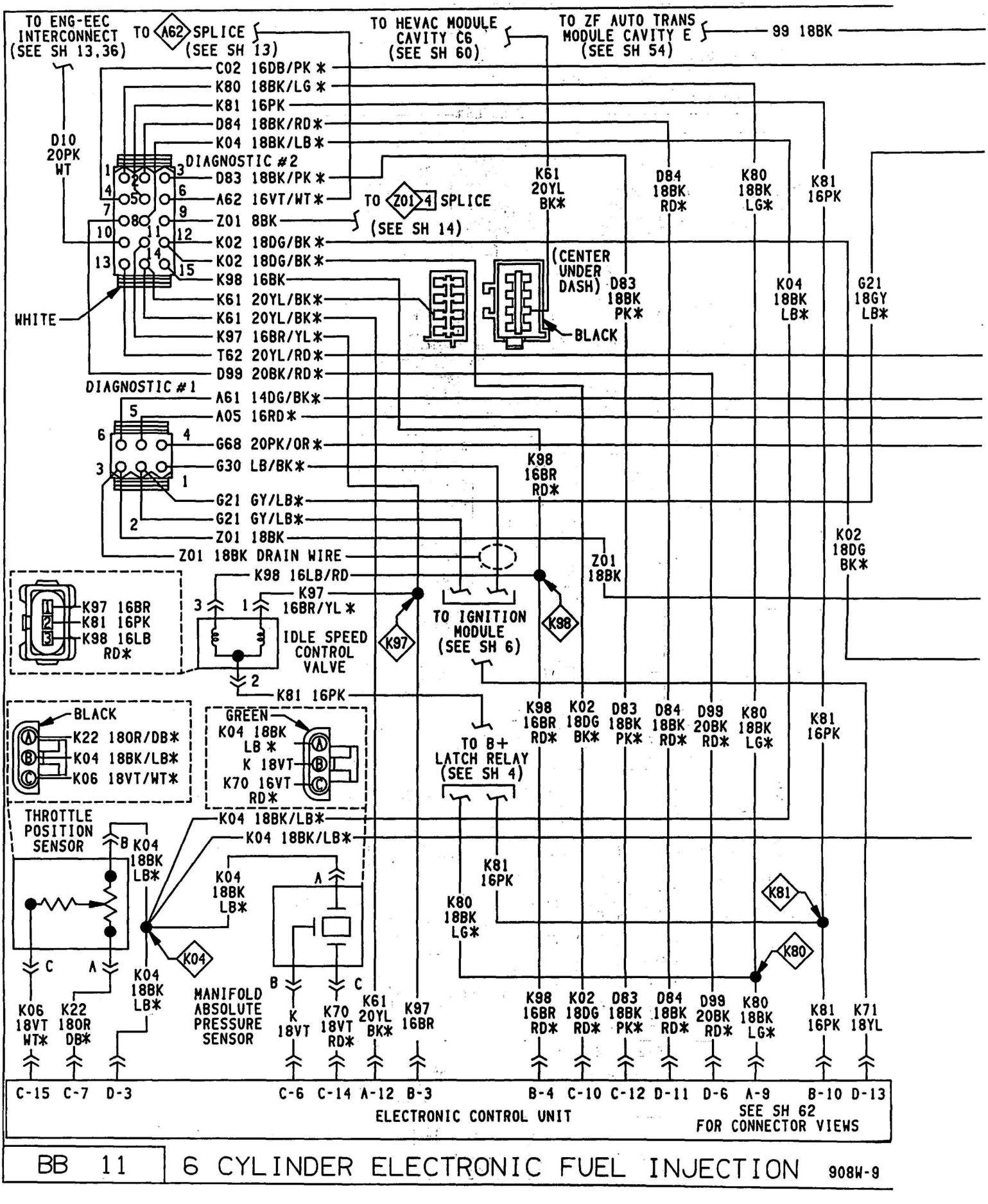
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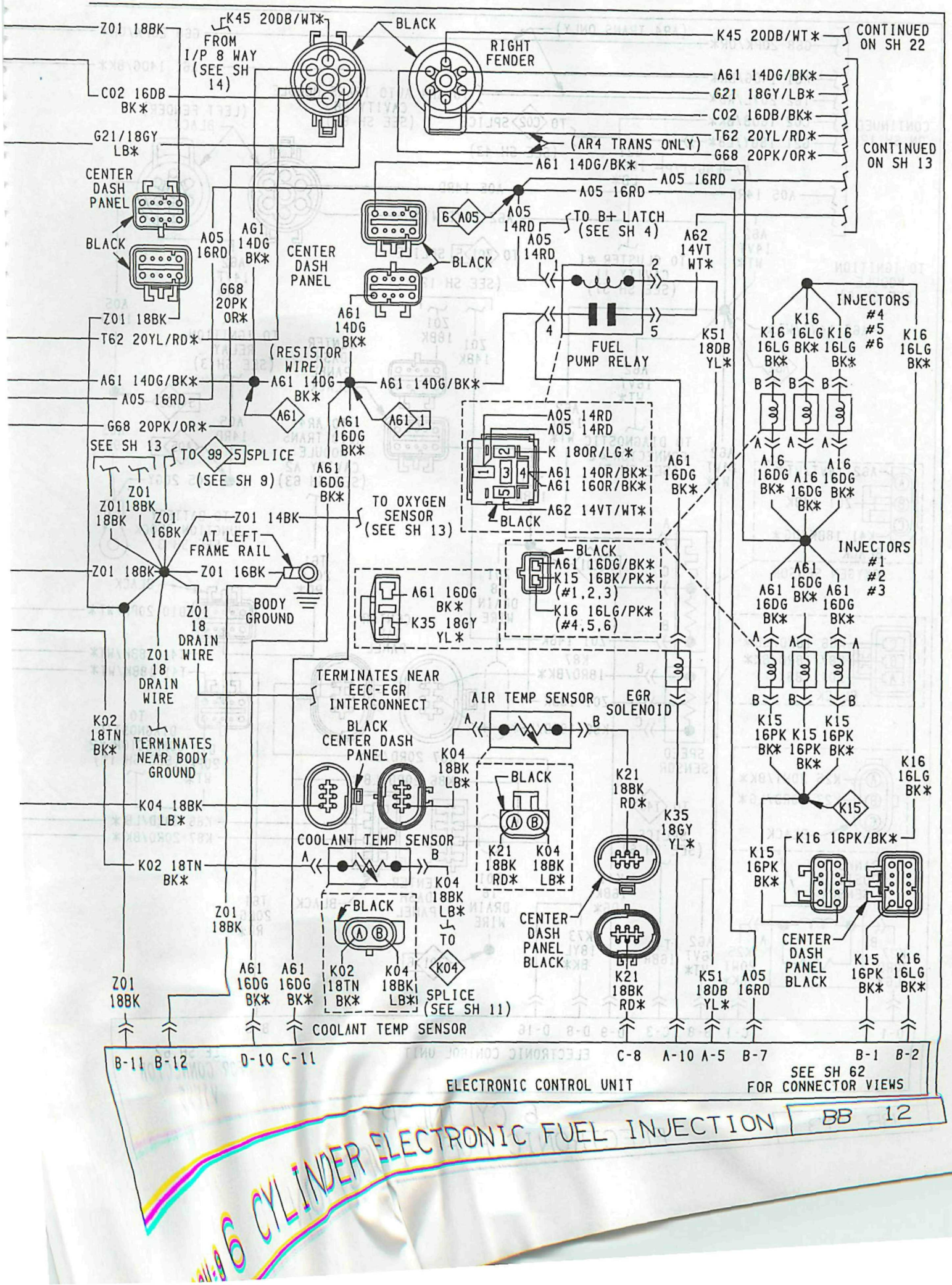
4 CYLINDER
ELECTRONIC FUEL INJECTION

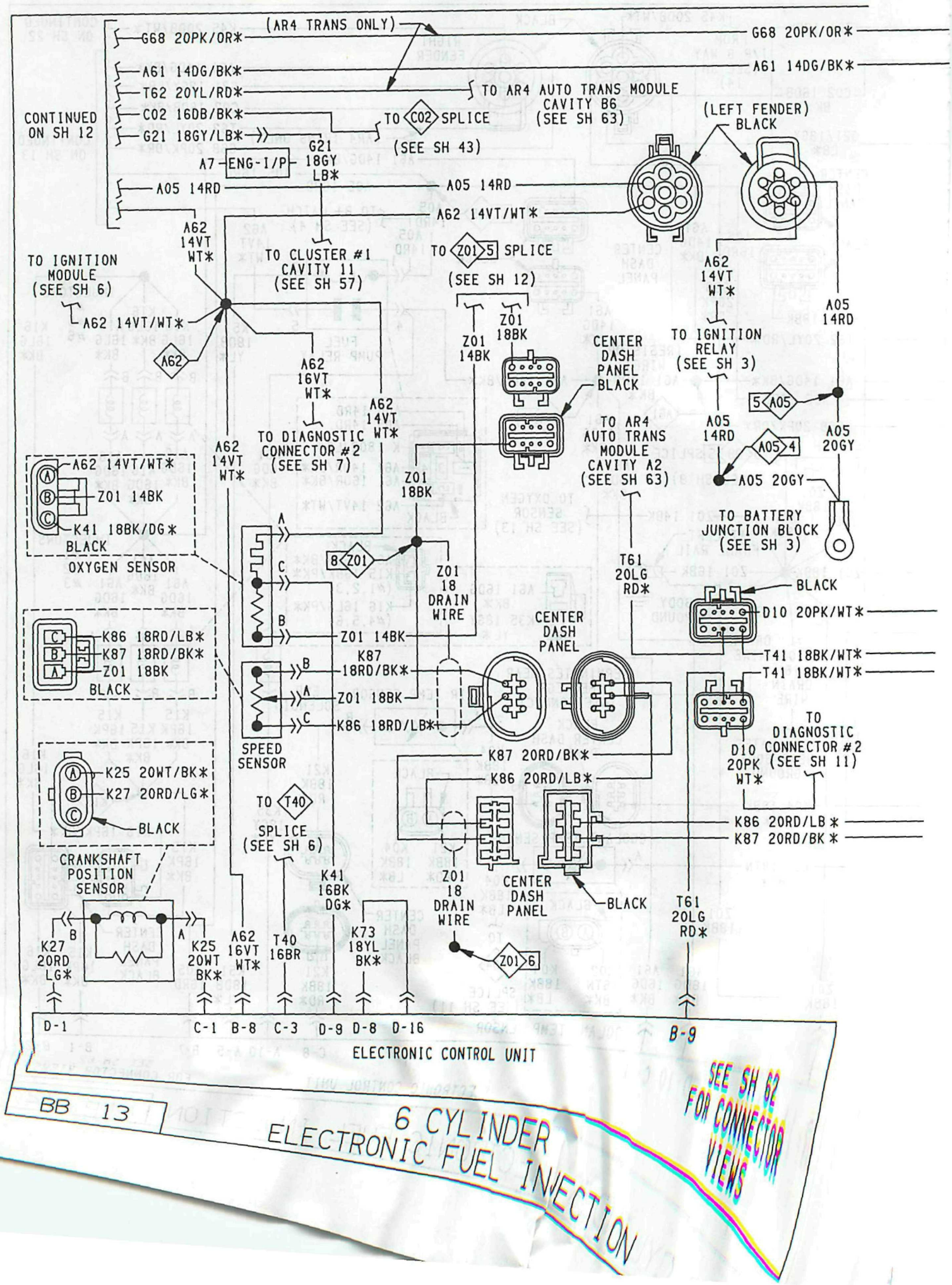
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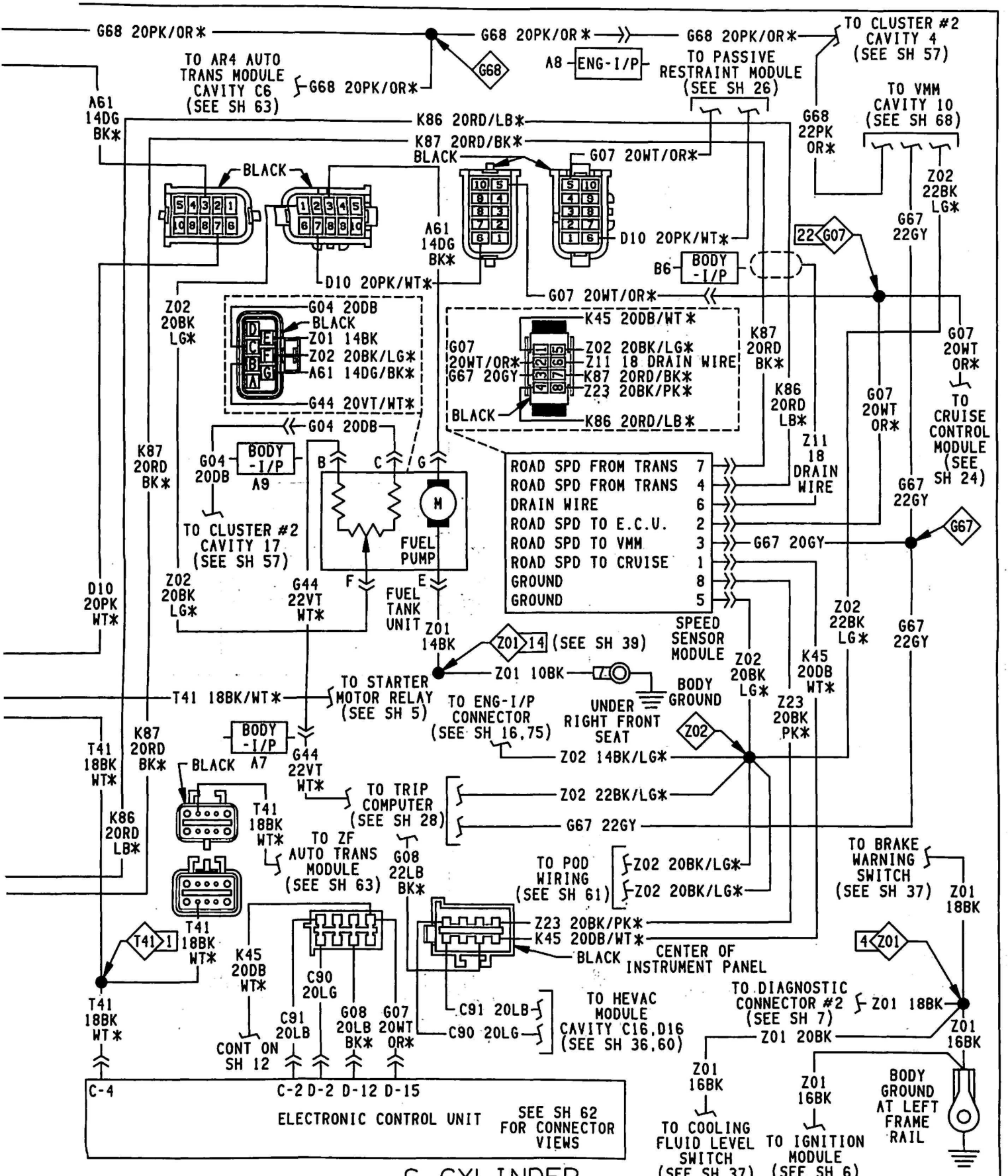
BB 10



BB 11 6 CYLINDER ELECTRONIC FUEL INJECTION 908W-9


Z01 18BK
K45 20DB/WT*
FROM I/P 8 WAY (SEE SH 14)
BLACK
RIGHT FENDER
K45 20DB/WT*
CONTINUED ON SH 22
C02 16DB BK*
A61 14DG/BK*
G21 18GY/LB*
C02 16DB/BK*
T62 20YL/RD*
G68 20PK/OR*
(AR4 TRANS ONLY)
CONTINUED ON SH 13
G21/18GY LB*
CENTER DASH PANEL
BLACK
A05 16RD
A61 14DG/BK*
A05 16RD
6 A05
A05 14RD
TO B+ LATCH (SEE SH 4)
A05 16RD
AG1 14DG BK*
G68 20PK OR*
CENTER DASH PANEL
BLACK
A61 14DG BK*
A05 14RD
A62 14VT WT*
Z01 18BK
T62 20YL/RD*
(RESISTOR WIRE)
FUEL PUMP RELAY
K51 18DB YL*
A61 14DG/BK*
A61 14DG BK*
A61 14DG/BK*
A05 16RD
A61
A61 1
A05 14RD
A05 14RD
K 180R/LG*
G68 20PK/OR*
A61 140R/BK*
A61 160R/BK*
A62 14VT/WT*
BLACK
SEE SH 13
TO 99 5 SPLICE (SEE SH 9)
A61 16DG BK*
A61 16DG BK*
INJECTORS #4 #5 #6
K16 16LG BK*
K16 16LG BK*
K16 16LG BK*
K16 16LG BK*
A16 16DG BK*
A16 16DG BK*
A16 16DG BK*
Z01 18BK
Z01 18BK
Z01 16BK
Z01 14BK
TO OXYGEN SENSOR (SEE SH 13)
AT LEFT FRAME RAIL
Z01 18BK
Z01 16BK
BODY GROUND
BLACK
A61 16DG/BK*
K15 16BK/PK* (#1,2,3)
K16 16LG/PK* (#4,5,6)
A61 16DG BK*
K35 18GY YL*
INJECTORS #1 #2 #3
A61 16DG BK*
A61 16DG BK*
A61 16DG BK*
Z01 18 DRAIN WIRE
Z01 18 DRAIN WIRE
TERMINATES NEAR EEC-EGR INTERCONNECT
AIR TEMP SENSOR
EGR SOLENOID
K02 18TN BK*
TERMINATES NEAR BODY GROUND
BLACK CENTER DASH PANEL
K04 18BK LB*
K15 16PK BK*
K15 16PK BK*
K15 16PK BK*
K16 16LG BK*
K04 18BK LB*
BLACK
K21 18BK RD*
K35 18GY YL*
K15
K16 16PK/BK*
K04 18BK LB*
COOLANT TEMP SENSOR
K21 18BK RD*
K04 18BK LB*
K02 18TN BK*
K15 16PK BK*
BLACK
K02 18TN BK*
K04 18BK LB*
TO
CENTER DASH PANEL BLACK
CENTER DASH PANEL BLACK
Z01 18BK
Z01 18BK
A61 16DG BK*
A61 16DG BK*
K04
K21 18BK RD*
K51 18DB YL*
A05 16RD
K15 16PK BK*
K16 16LG BK*
SPLICE (SEE SH 11)
COOLANT TEMP SENSOR
B-11 B-12
D-10 C-11
C-8
A-10 A-5
B-7
B-1 B-2
ELECTRONIC CONTROL UNIT
SEE SH 62 FOR CONNECTOR VIEWS
6 CYLINDER ELECTRONIC FUEL INJECTION
BB 12

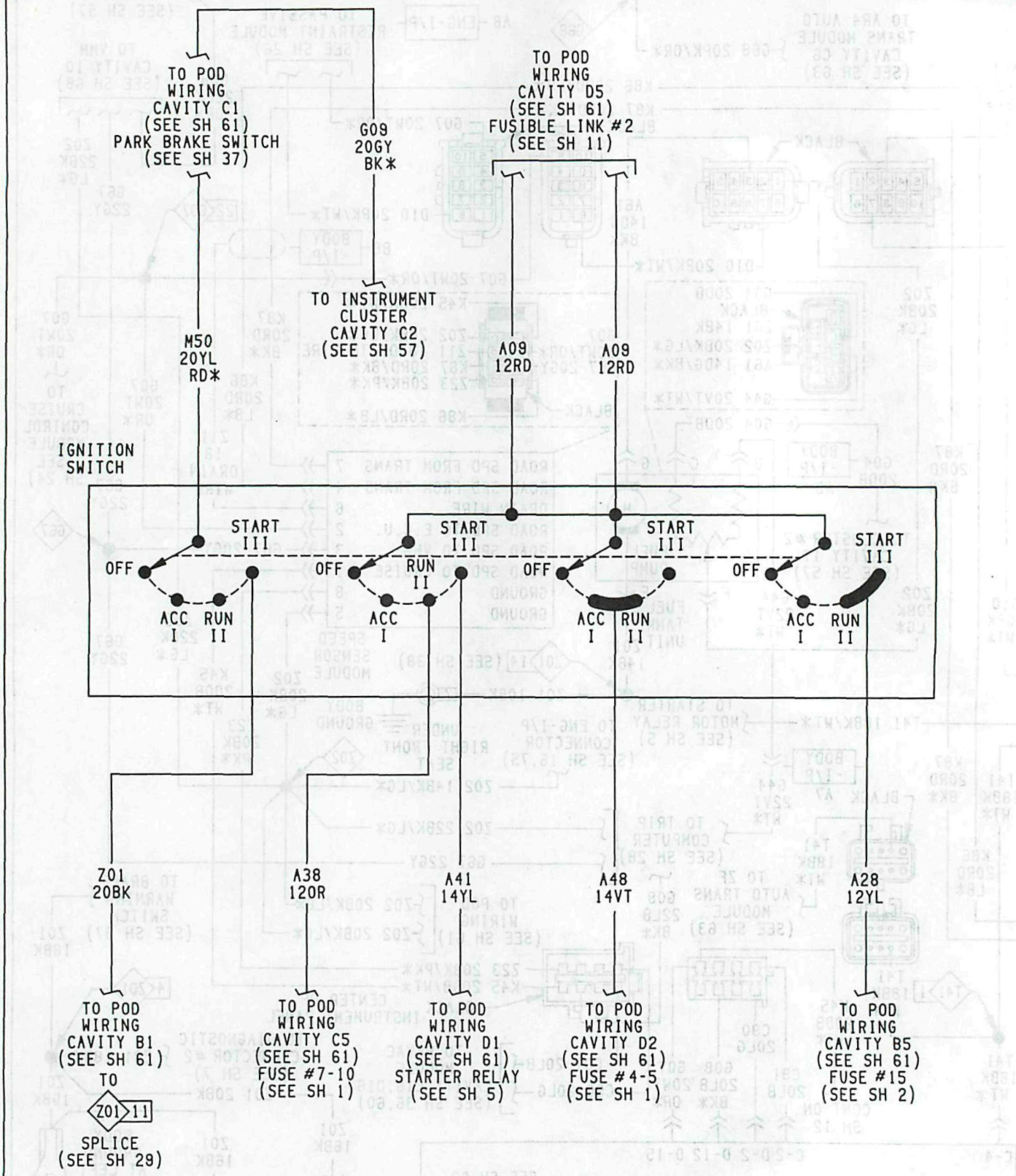

(AR4 TRANS ONLY)
G68 20PK/OR*
G68 20PK/OR*
A61 14DG/BK*
A61 14DG/BK*
T62 20YL/RD*
TO AR4 AUTO TRANS MODULE CAVITY B6 (SEE SH 63)
CONTINUED ON SH 12
C02 16DB/BK*
TO C02 SPLICE (SEE SH 43)
G21 18GY/LB*
A7 ENG-I/P
G21 18GY LB*
A05 14RD
A05 14RD
A62 14VT/WT*
(LEFT FENDER) BLACK
A62 14VT WT*
TO IGNITION MODULE (SEE SH 6)
A62 14VT/WT*
A62
TO CLUSTER #1 CAVITY 11 (SEE SH 57)
TO Z01 5 SPLICE (SEE SH 12)
A62 16VT WT*
A62 14VT WT*
TO DIAGNOSTIC CONNECTOR #2 (SEE SH 7)
Z01 14BK
Z01 18BK
CENTER DASH PANEL BLACK
TO IGNITION RELAY (SEE SH 3)
5 A05
A05 14RD
A05 20GY
A05 4
A05 20GY
TO AR4 AUTO TRANS MODULE CAVITY A2 (SEE SH 63)
TO BATTERY JUNCTION BLOCK (SEE SH 3)
A62 14VT/WT*
Z01 14BK
K41 18BK/DG*
BLACK
OXYGEN SENSOR
A
B
C
8 Z01
Z01 18 DRAIN WIRE
T61 20LG RD*
BLACK
D10 20PK/WT*
CENTER DASH PANEL
K86 18RD/LB*
K87 18RD/BK*
Z01 18BK
BLACK
K87 18RD/BK*
Z01 18BK
K86 18RD/LB*
T41 18BK/WT*
T41 18BK/WT*
SPEED SENSOR
K87 20RD/BK*
K86 20RD/LB*
D10 20PK WT*
TO DIAGNOSTIC CONNECTOR #2 (SEE SH 11)
K25 20WT/BK*
K27 20RD/LG*
BLACK
TO T40 SPLICE (SEE SH 6)
K86 20RD/LB*
K87 20RD/BK*
CRANKSHAFT POSITION SENSOR
K41 16BK DG*
Z01 18 DRAIN WIRE
CENTER DASH PANEL
BLACK
T61 20LG RD*
Z01 6
K27 20RD LG*
K25 20WT BK*
A62 16VT WT*
T40 16BR
K73 18YL BK*
D-1
C-1
B-8
C-3
D-9
D-8
D-16
B-9
ELECTRONIC CONTROL UNIT
SEE SH 62 FOR CONNECTOR VIEWS
BB 13
6 CYLINDER
ELECTRONIC FUEL INJECTION



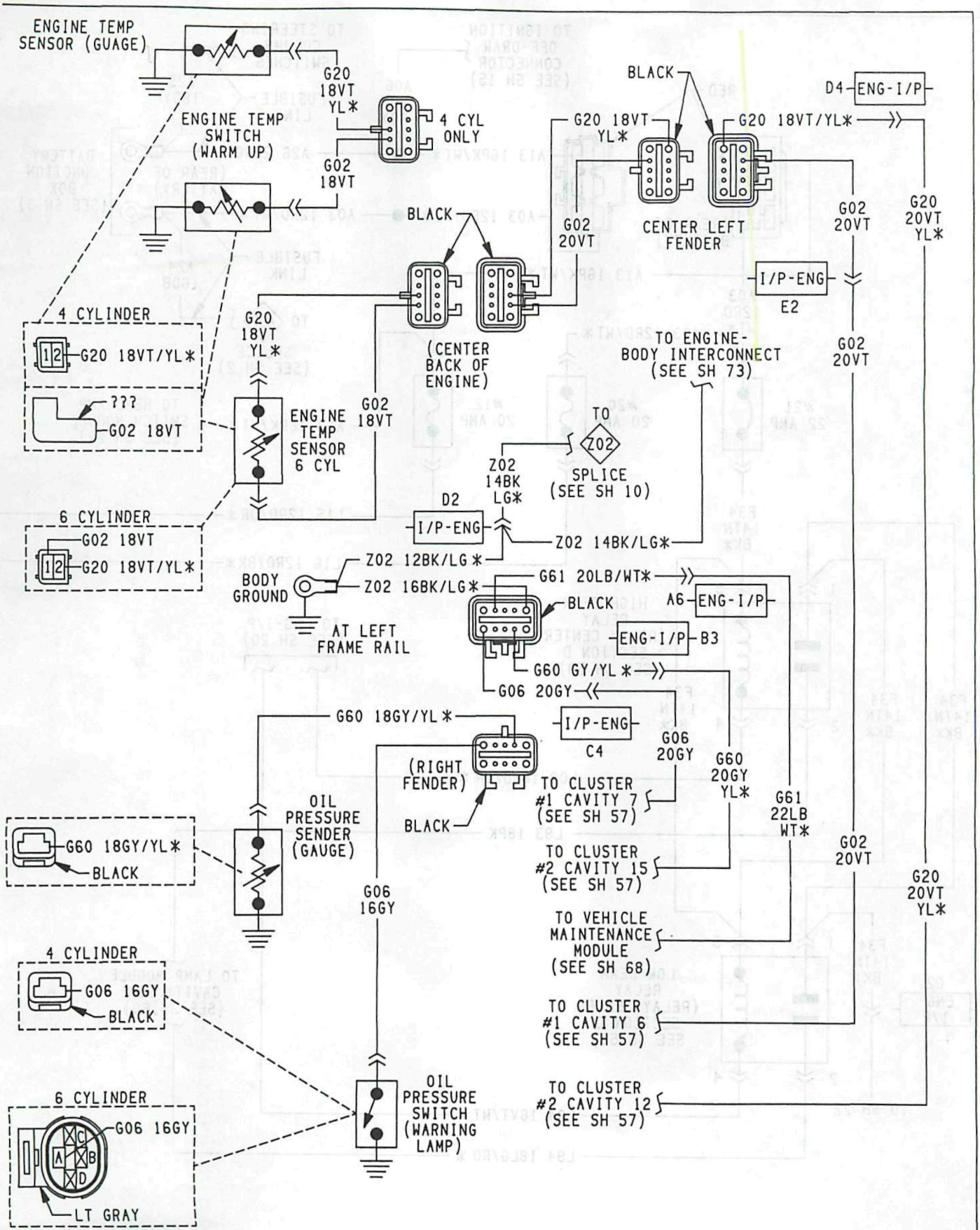
6 CYLINDER
ELECTRONIC FUEL INJECTION

908W-9

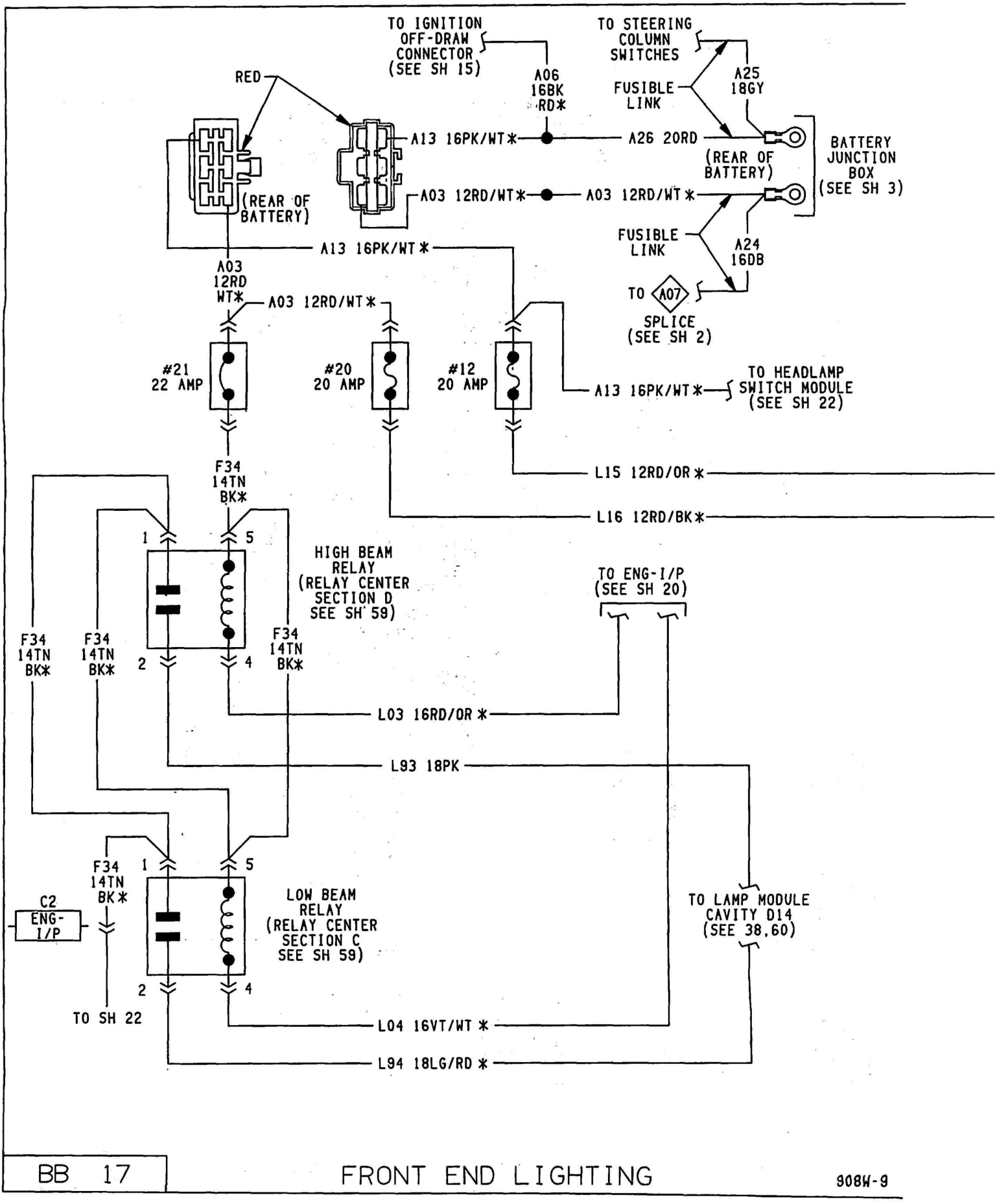
BB 14



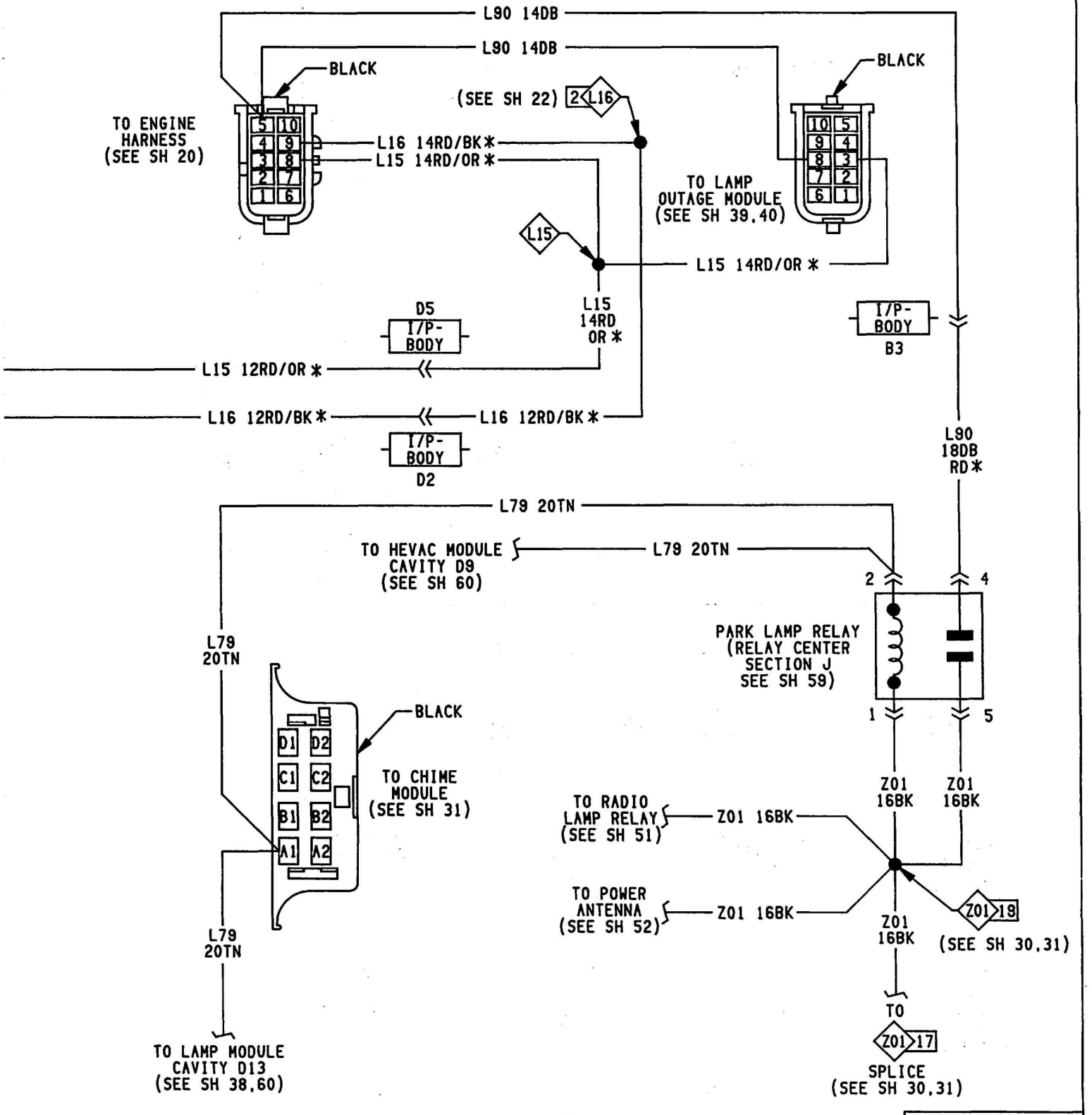
BB 15 IGNITION SWITCH 908W-9

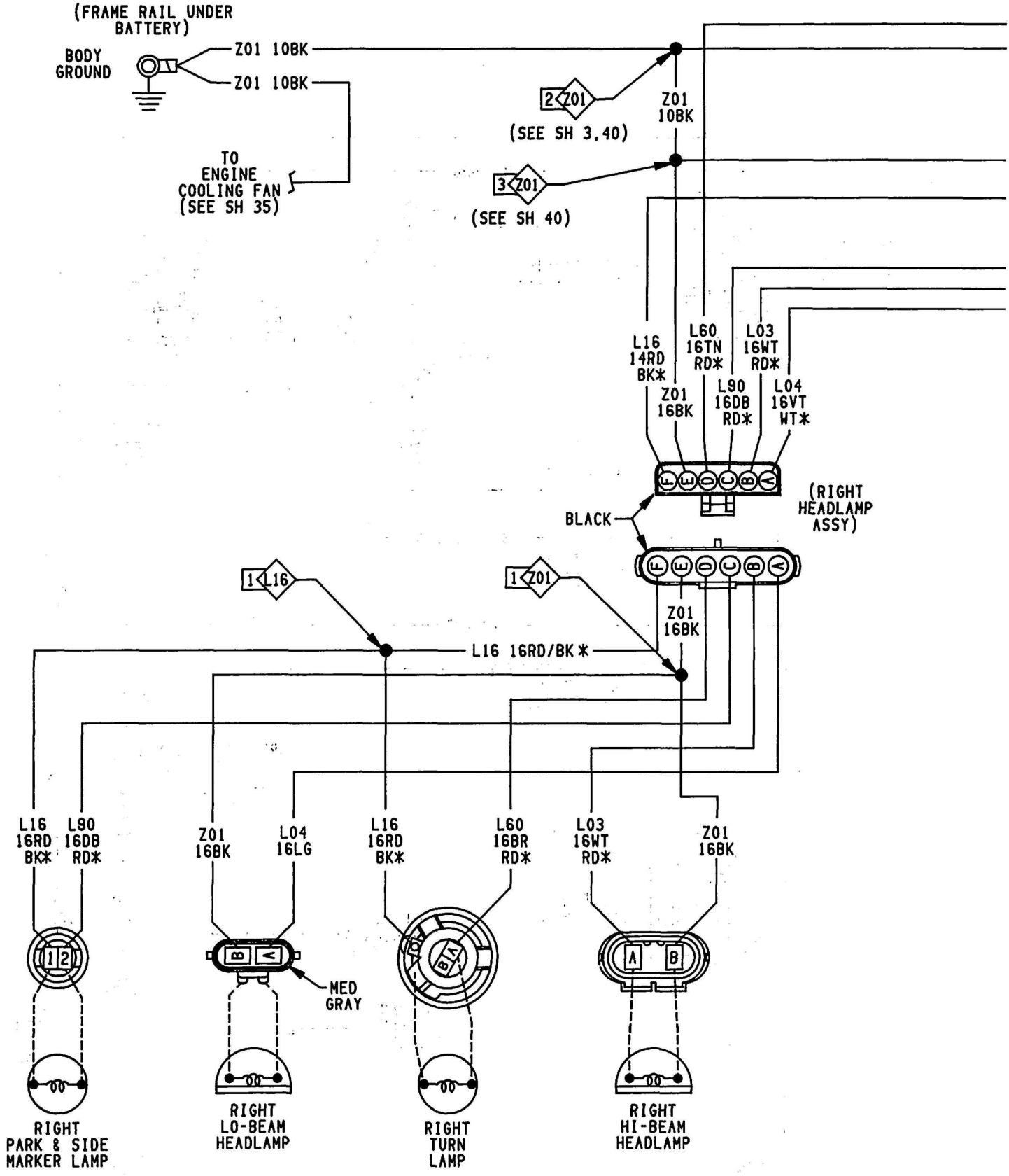


808W-9 OIL PRESSURE & TEMPERATURE SYSTEM BB 16



BB 17 FRONT END LIGHTING 908W-9

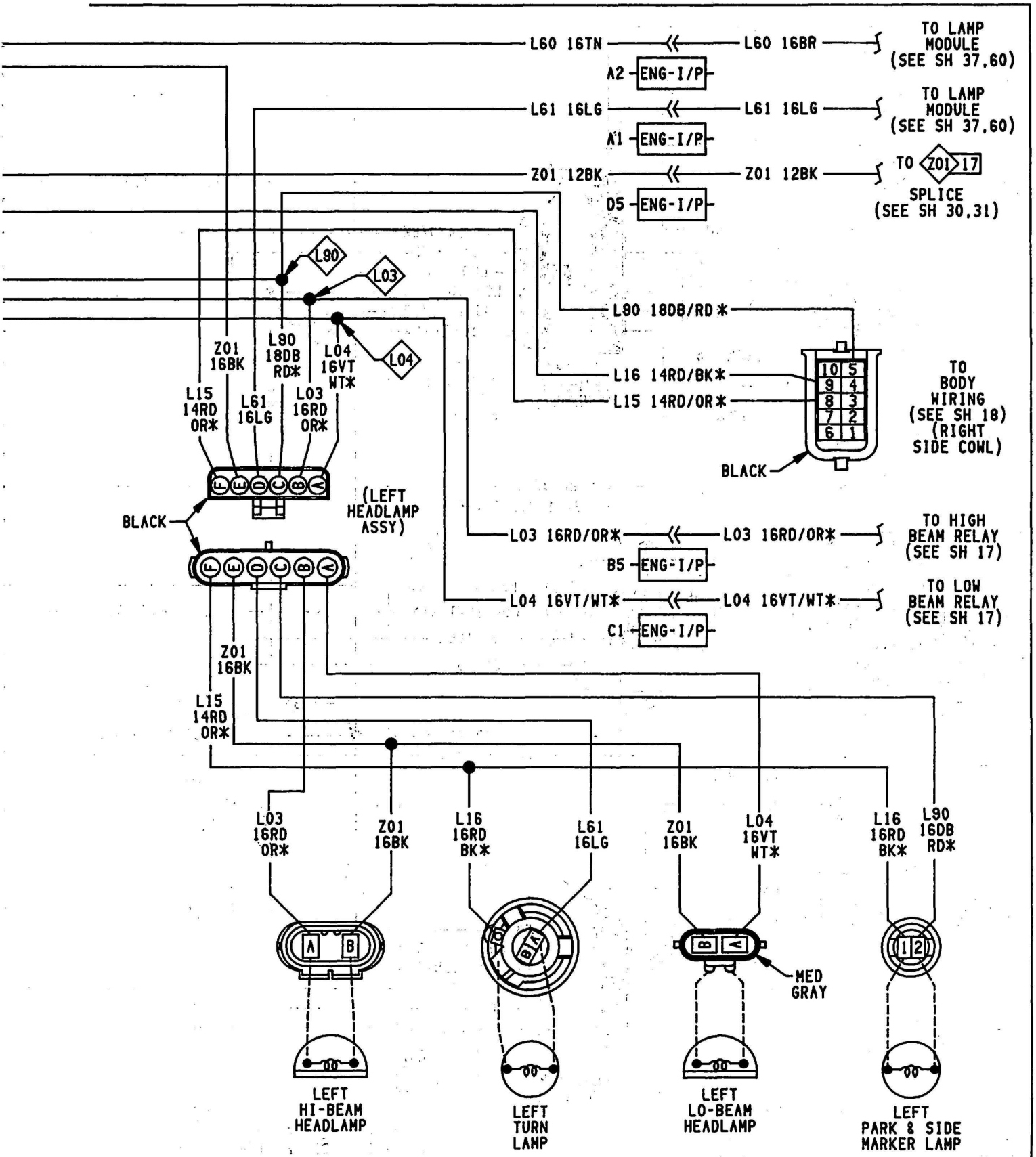

L90 14DB
L90 14DB
BLACK
BLACK
TO ENGINE HARNESS (SEE SH 20)
(SEE SH 22) 2 L16
L16 14RD/BK*
L15 14RD/OR*
TO LAMP OUTAGE MODULE (SEE SH 39,40)
L15
L15 14RD/OR*
D5 I/P-BODY
L15 14RD OR*
I/P-BODY B3
L15 12RD/OR*
L16 12RD/BK*
L16 12RD/BK*
I/P-BODY D2
L90 18DB RD*
L79 20TN
TO HEVAC MODULE CAVITY D9 (SEE SH 60)
L79 20TN
2
4
PARK LAMP RELAY (RELAY CENTER SECTION J SEE SH 59)
1
5
L79 20TN
BLACK
TO CHIME MODULE (SEE SH 31)
Z01 16BK
Z01 16BK
TO RADIO LAMP RELAY (SEE SH 51)
Z01 16BK
TO POWER ANTENNA (SEE SH 52)
Z01 16BK
Z01 19
(SEE SH 30,31)
Z01 16BK
L79 20TN
TO
Z01 17
SPLICE (SEE SH 30,31)
TO LAMP MODULE CAVITY D13 (SEE SH 38,60)



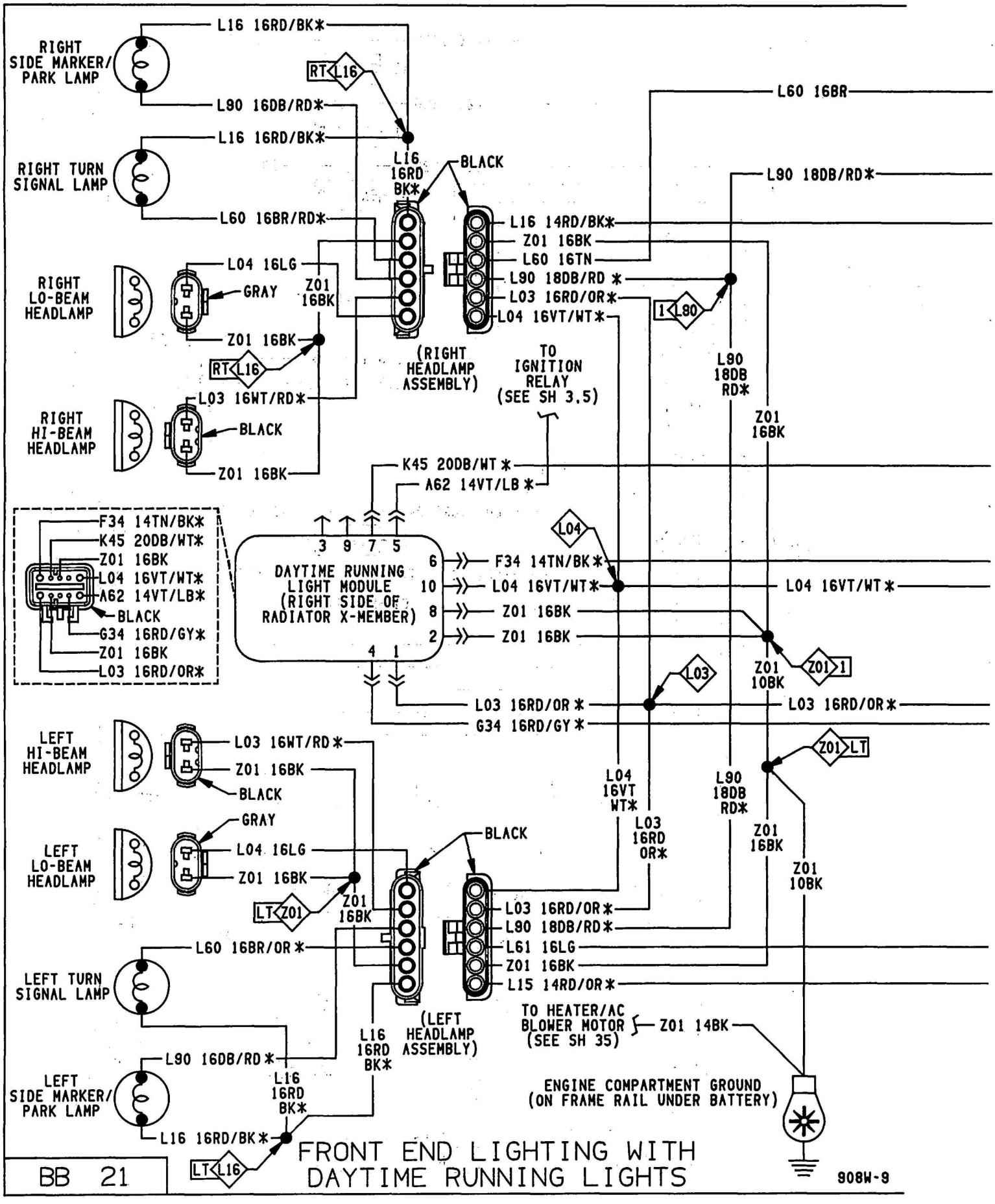
FRONT END LIGHTING
WITHOUT DAYTIME RUNNING LIGHTS

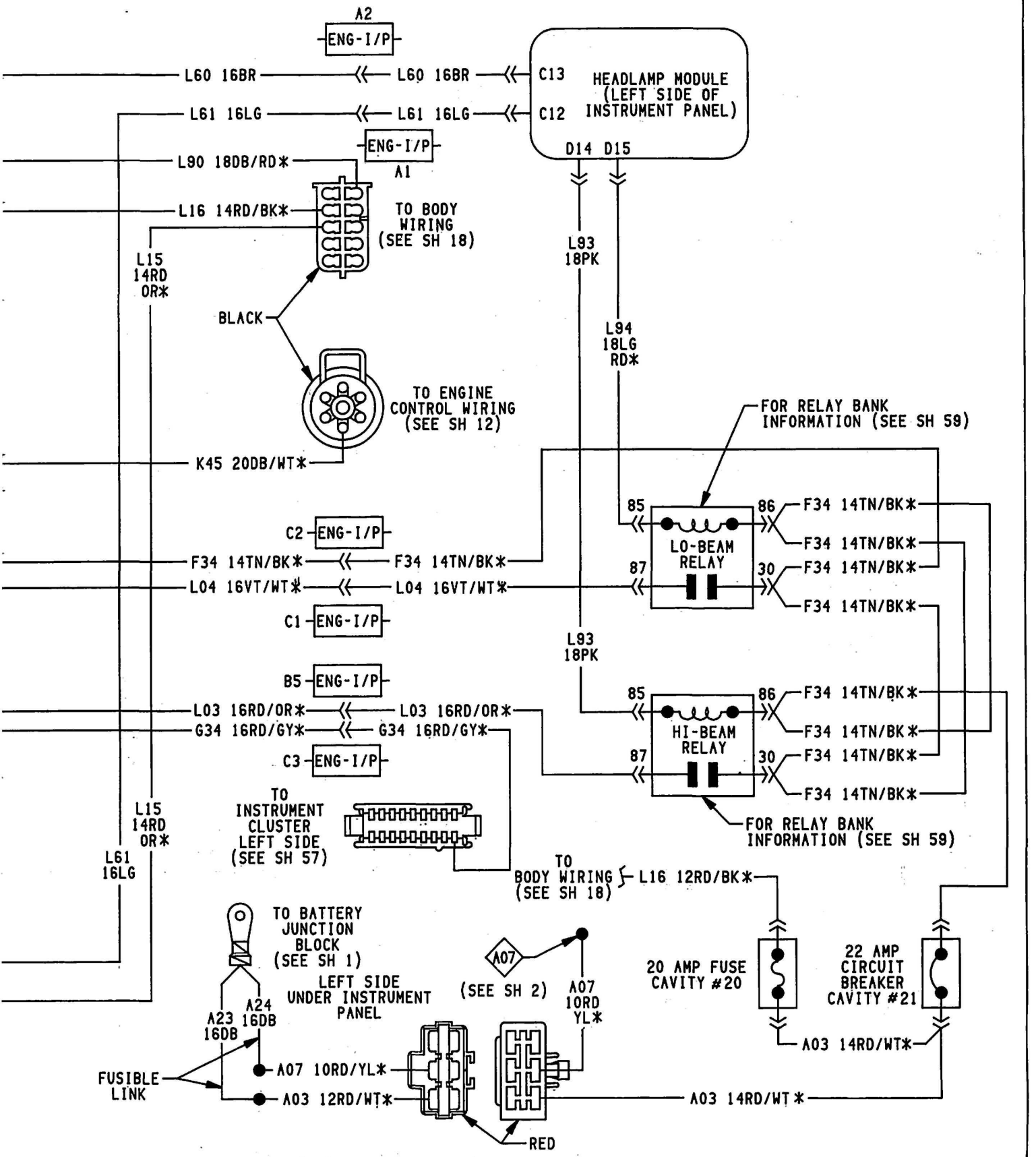
BB 19

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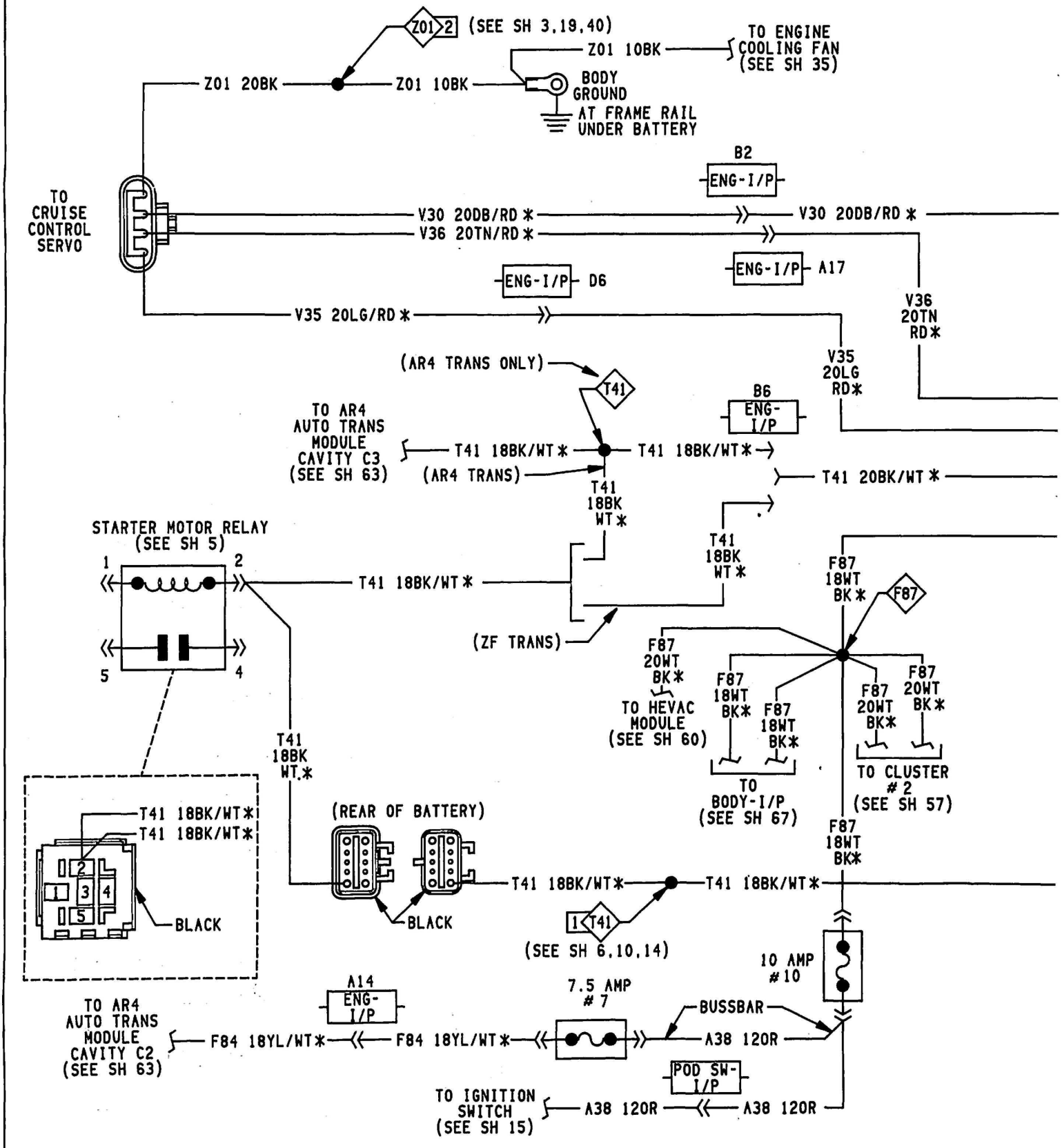


FRONT END LIGHTING
WITHOUT DAYTIME RUNNING LIGHTS


RIGHT SIDE MARKER/ PARK LAMP
L16 16RD/BK*
RT L16
L90 16DB/RD*
RIGHT TURN SIGNAL LAMP
L16 16RD/BK*
L60 16BR/RD*
L16 16RD BK*
BLACK
RIGHT LO-BEAM HEADLAMP
L04 16LG
GRAY
Z01 16BK
Z01 16BK
RT L16
Z01 16BK
RIGHT HI-BEAM HEADLAMP
L03 16WT/RD*
BLACK
Z01 16BK
(RIGHT HEADLAMP ASSEMBLY)
L16 14RD/BK*
Z01 16BK
L60 16TN
L90 18DB/RD*
L03 16RD/OR*
L04 16VT/WT*
L60 16BR
L90 18DB/RD*
1 L80
TO IGNITION RELAY (SEE SH 3.5)
L90 18DB RD*
Z01 16BK
K45 20DB/WT*
A62 14VT/LB*
F34 14TN/BK*
K45 20DB/WT*
Z01 16BK
L04 16VT/WT*
A62 14VT/LB*
BLACK
G34 16RD/GY*
Z01 16BK
L03 16RD/OR*
3 9 7 5
DAYTIME RUNNING LIGHT MODULE (RIGHT SIDE OF RADIATOR X-MEMBER)
4 1
6 F34 14TN/BK*
10 L04 16VT/WT*
8 Z01 16BK
2 Z01 16BK
L04
L04 16VT/WT*
L03
Z01 10BK
Z01 1
L03 16RD/OR*
L03 16RD/OR*
G34 16RD/GY*
LEFT HI-BEAM HEADLAMP
L03 16WT/RD*
Z01 16BK
BLACK
LEFT LO-BEAM HEADLAMP
GRAY
L04 16LG
Z01 16BK
LT Z01
Z01 16BK
L04 16VT WT*
L03 16RD OR*
L90 18DB RD*
Z01 16BK
Z01 10BK
Z01 LT
BLACK
L03 16RD/OR*
L90 18DB/RD*
L61 16LG
Z01 16BK
L15 14RD/OR*
L60 16BR/OR*
LEFT TURN SIGNAL LAMP
L90 16DB/RD*
LEFT SIDE MARKER/ PARK LAMP
L16 16RD/BK*
L16 16RD BK*
(LEFT HEADLAMP ASSEMBLY)
TO HEATER/AC BLOWER MOTOR (SEE SH 35)
Z01 14BK
ENGINE COMPARTMENT GROUND (ON FRAME RAIL UNDER BATTERY)
LT L16
BB 21
FRONT END LIGHTING WITH DAYTIME RUNNING LIGHTS
908W-9



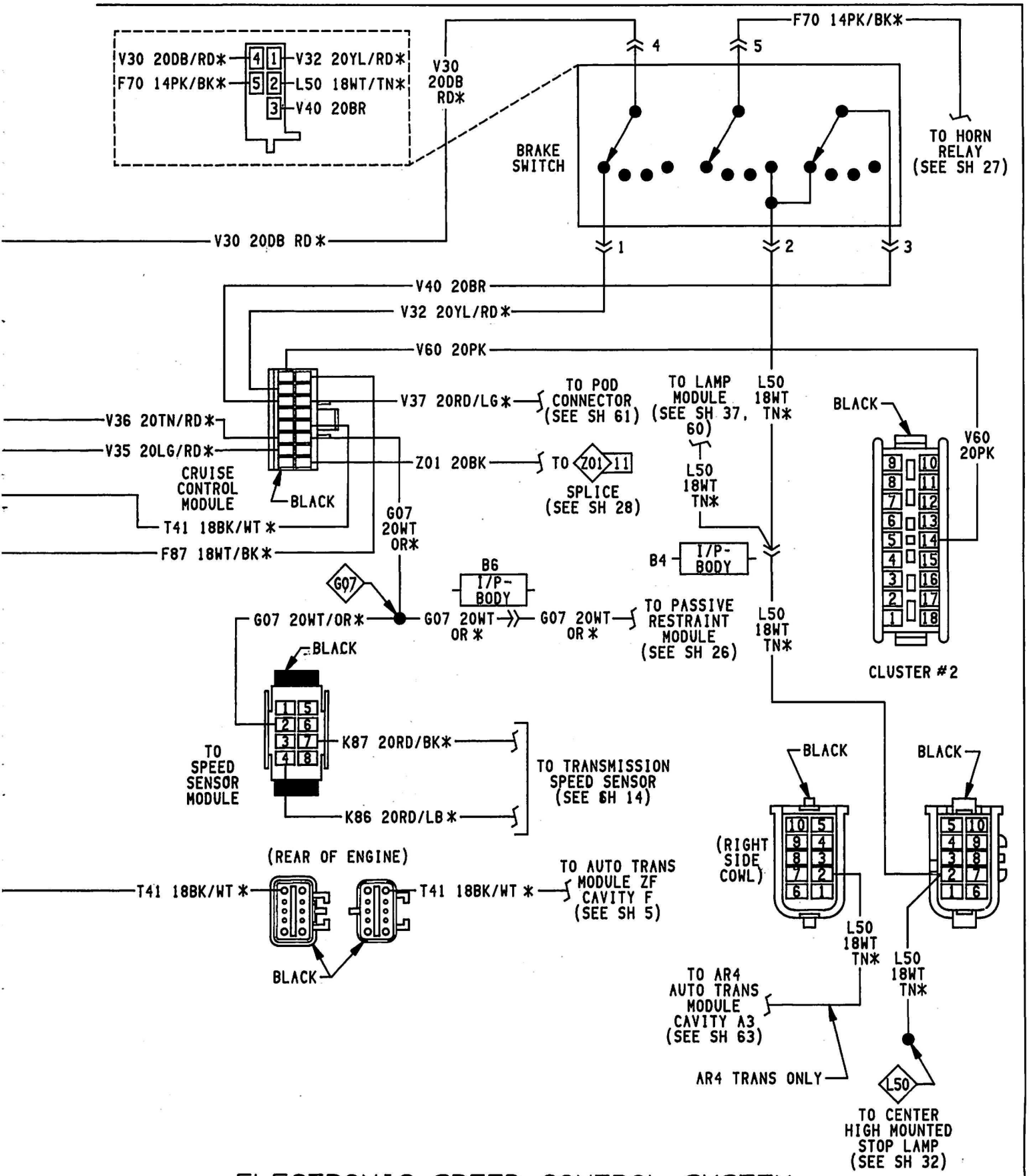
FRONT END LIGHTING WITH DAYTIME RUNNING LIGHTS



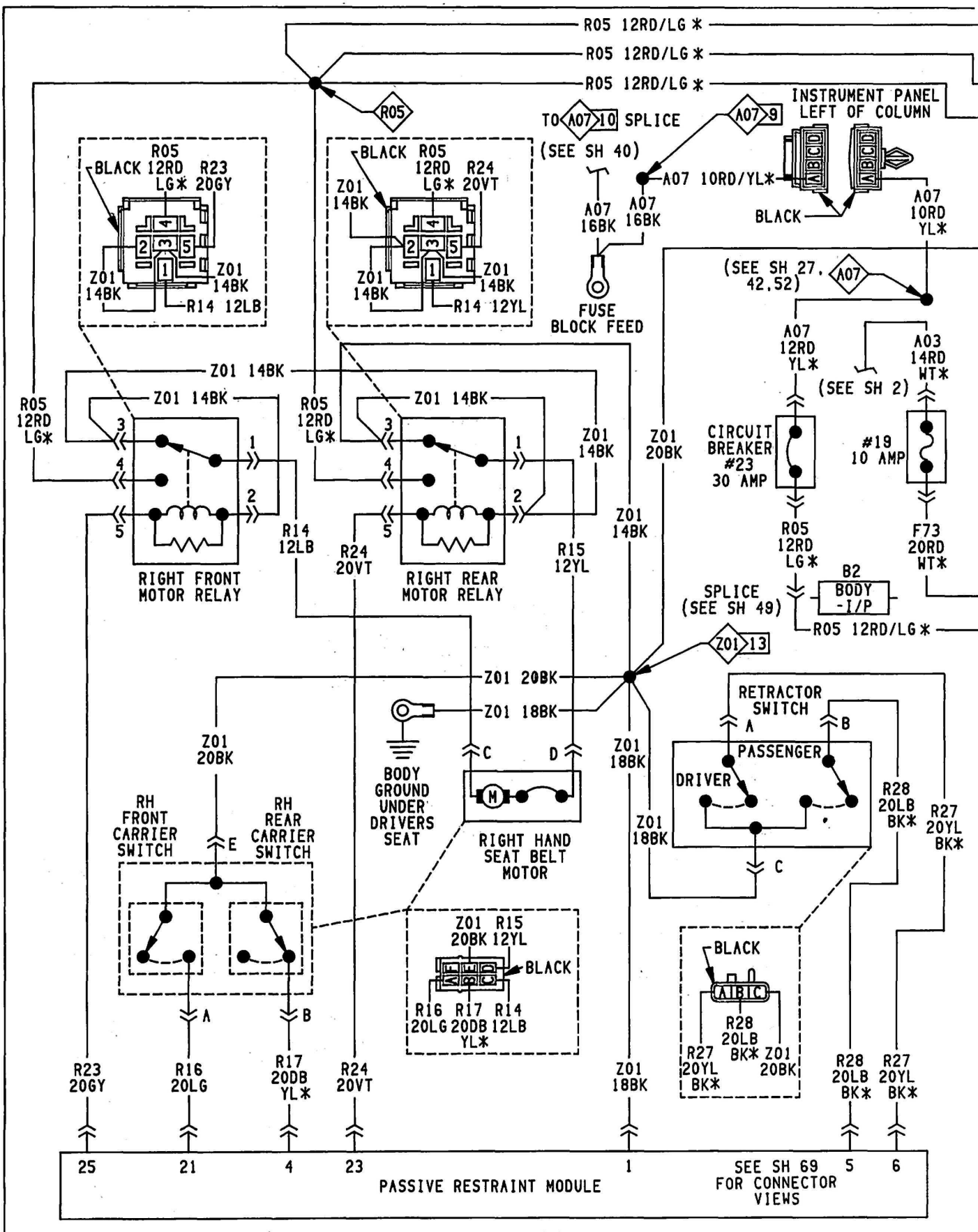
ELECTRONIC SPEED CONTROL SYSTEM (AUTO TRANSMISSION)

BB 23

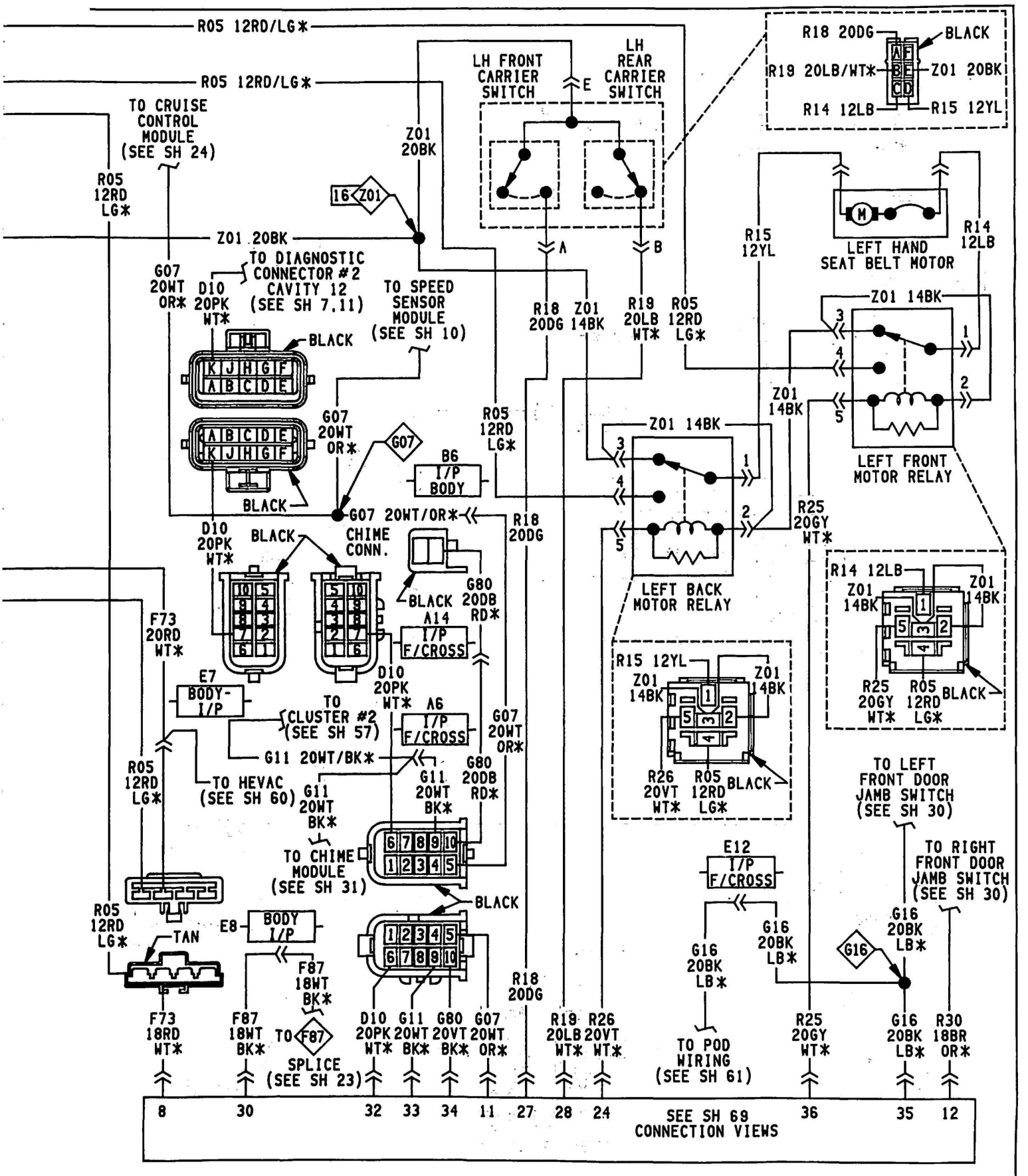
908W-9

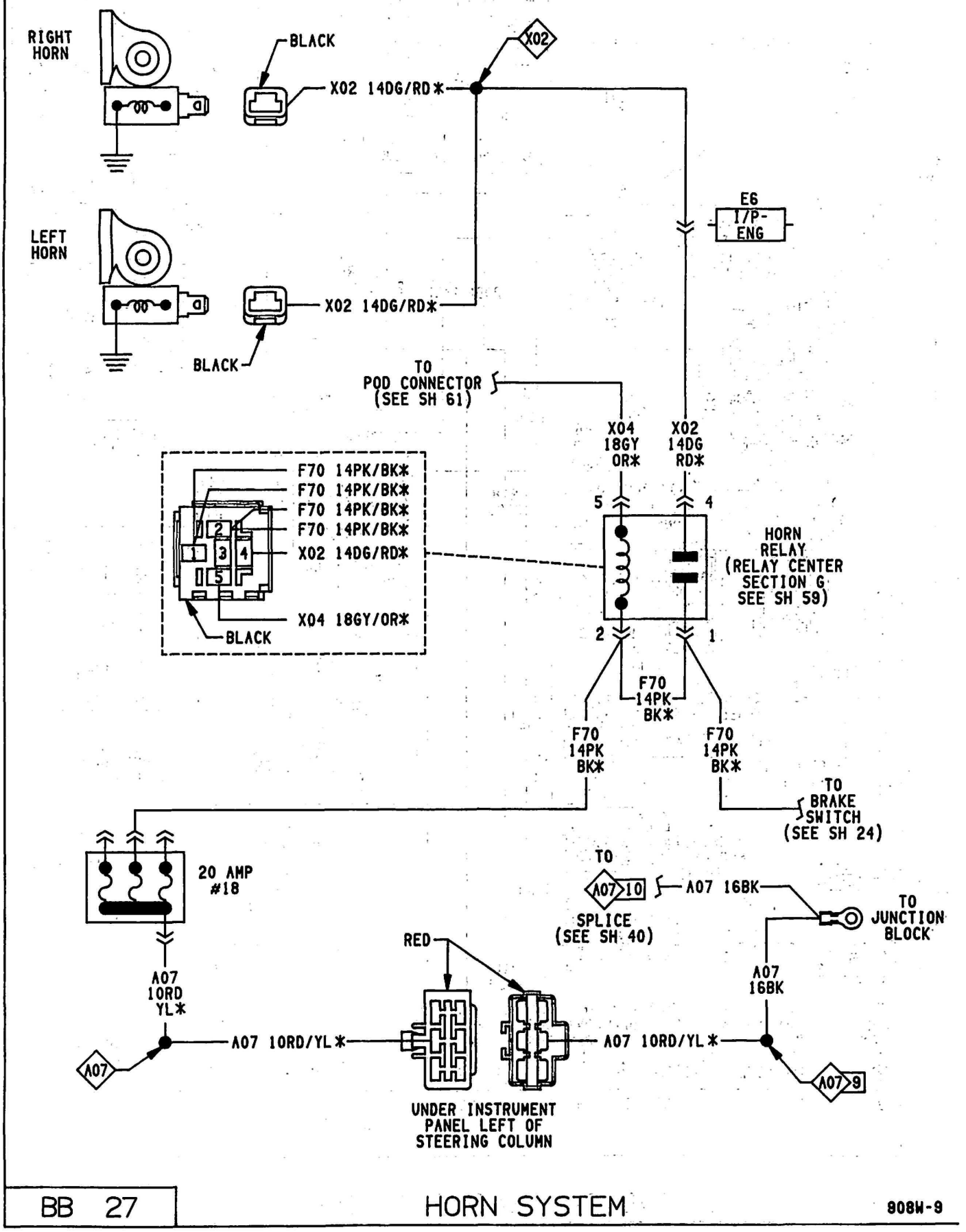


ELECTRONIC SPEED CONTROL SYSTEM (AUTO TRANSMISSION)

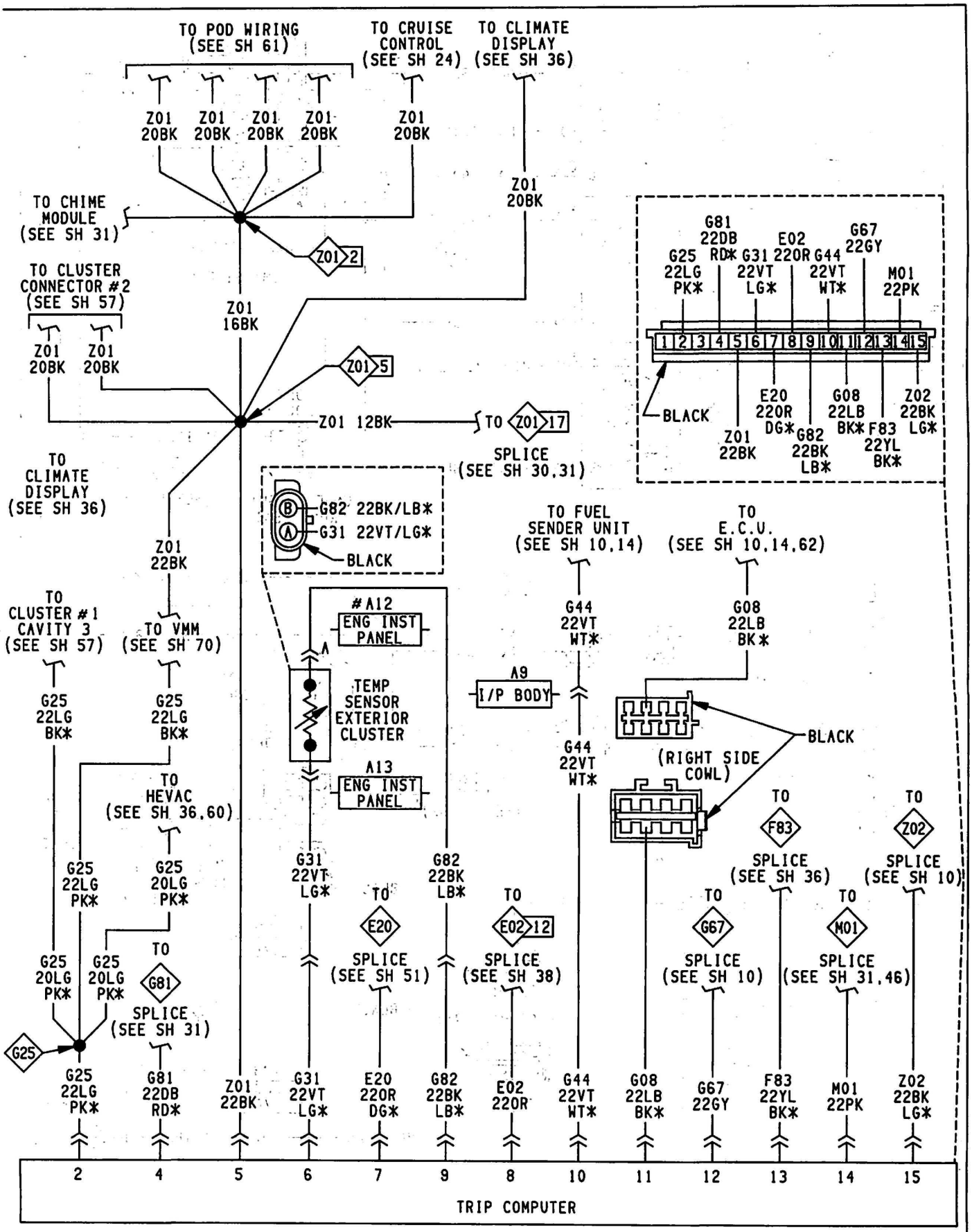


BB 25 PASSIVE RESTRAINT SYSTEM 908W-9

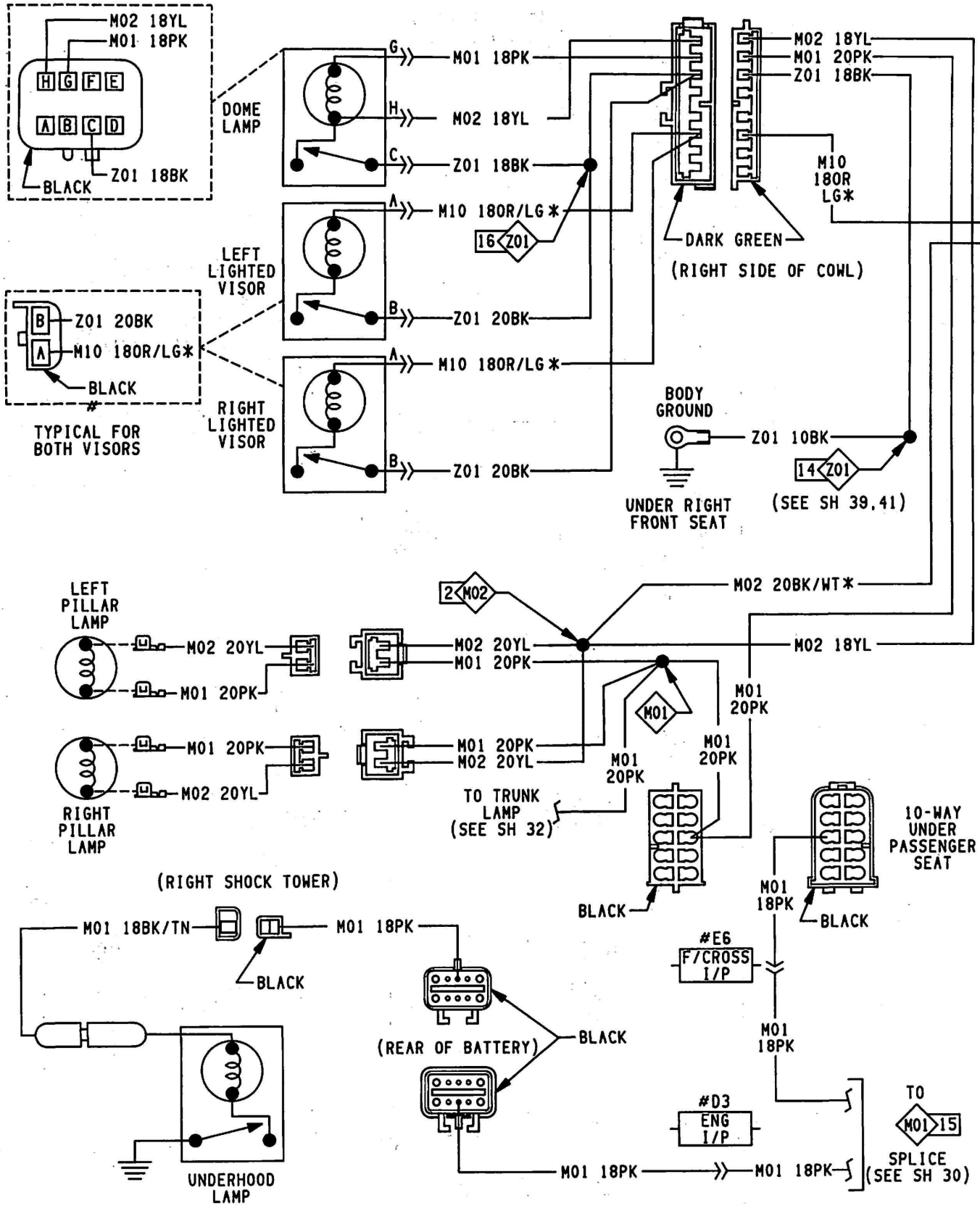

R05 12RD/LG*
R05 12RD/LG*
TO CRUISE CONTROL MODULE (SEE SH 24)
R05 12RD LG*
Z01 20BK
16 Z01
LH FRONT CARRIER SWITCH
E
LH REAR CARRIER SWITCH
A
B
R18 20DG
BLACK
R19 20LB/WT*
Z01 20BK
R14 12LB
R15 12YL
LEFT HAND SEAT BELT MOTOR
R15 12YL
R14 12LB
Z01 20BK
G07 20WT OR*
D10 20PK WT*
TO DIAGNOSTIC CONNECTOR #2 CAVITY 12 (SEE SH 7.11)
TO SPEED SENSOR MODULE (SEE SH 10)
R18 Z01 20DG 14BK
R19 20LB WT*
R05 12RD LG*
Z01 14BK
BLACK
G07 20WT OR*
G07
B6 I/P BODY
R05 12RD LG*
Z01 14BK
LEFT FRONT MOTOR RELAY
BLACK
G07 20WT/OR*
R18 20DG
Z01 14BK
LEFT BACK MOTOR RELAY
R25 20GY WT*
D10 20PK WT*
BLACK
CHIME CONN.
BLACK
G80 20DB RD*
A14 I/P F/CROSS
R14 12LB
Z01 14BK
Z01 14BK
R25 20GY WT*
R05 12RD LG*
BLACK
F73 20RD WT*
E7 BODY-I/P
D10 20PK WT*
A6 I/P F/CROSS
TO CLUSTER #2 (SEE SH 57)
G07 20WT OR*
G11 20WT/BK*
R15 12YL
Z01 14BK
Z01 14BK
R26 20VT WT*
R05 12RD LG*
BLACK
R05 12RD LG*
TO HEVAC (SEE SH 60)
G11 20WT BK*
G11 20WT BK*
G80 20DB RD*
TO CHIME MODULE (SEE SH 31)
TO LEFT FRONT DOOR JAMB SWITCH (SEE SH 30)
E12 I/P F/CROSS
TO RIGHT FRONT DOOR JAMB SWITCH (SEE SH 30)
BLACK
R05 12RD LG*
TAN
E8 BODY I/P
F87 18WT BK*
G16 20BK LB*
G16 20BK LB*
G16
G16 20BK LB*
R18 20DG
F73 18RD WT*
F87 18WT BK*
TO F87 SPLICE (SEE SH 23)
D10 20PK WT*
G11 20WT BK*
G80 20VT BK*
G07 20WT OR*
R19 20LB WT*
R26 20VT WT*
TO POD WIRING (SEE SH 61)
R25 20GY WT*
G16 20BK LB*
R30 18BR OR*
8
30
32
33
34
11
27
28
24
SEE SH 69 CONNECTION VIEWS
36
35
12



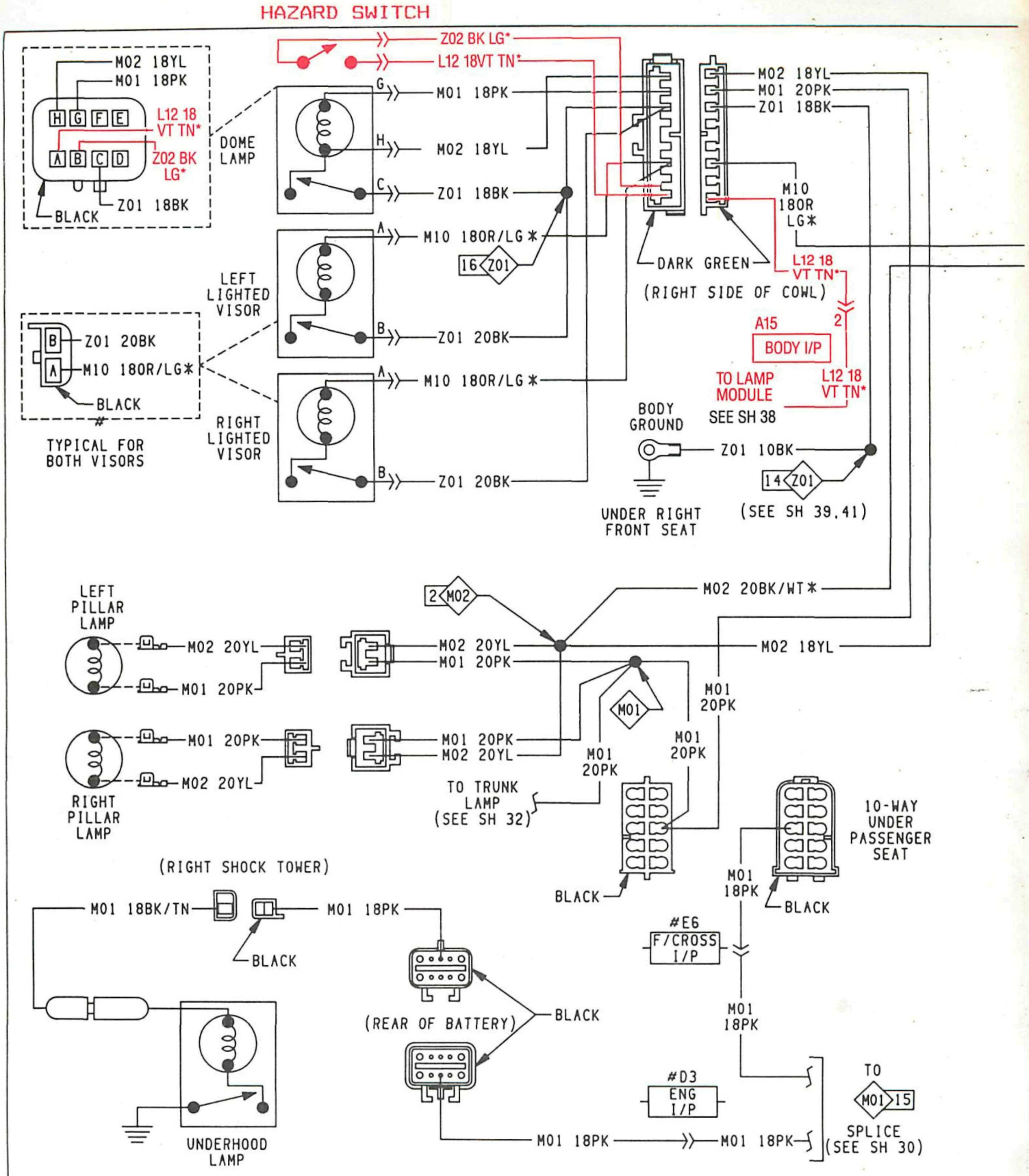
BB 27 HORN SYSTEM 8W-9



908W-9 ELECTRONIC TRIP COMPUTER BB 28



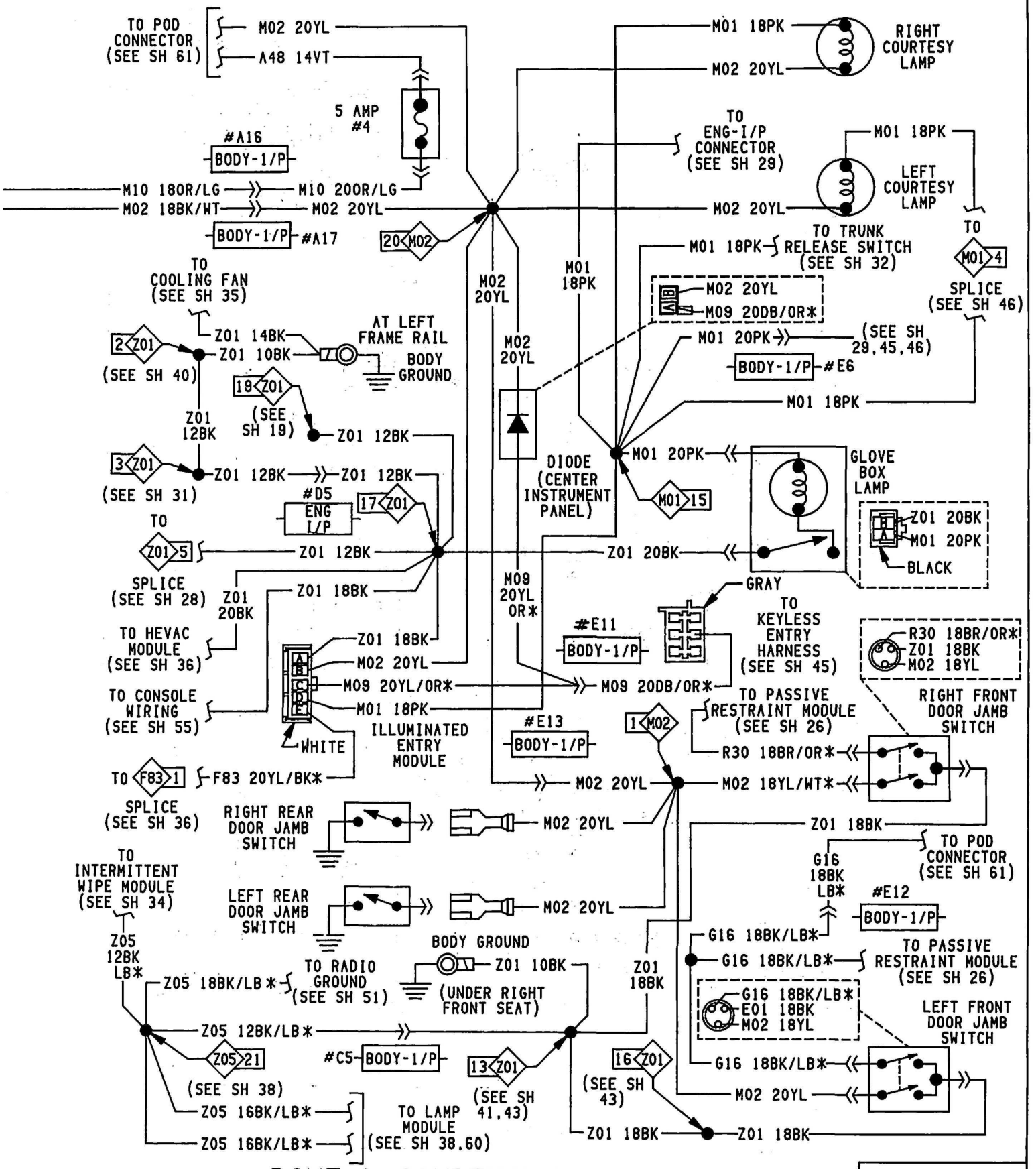
BB 29 DOME & COURTESY LAMP SYSTEM 908W-9



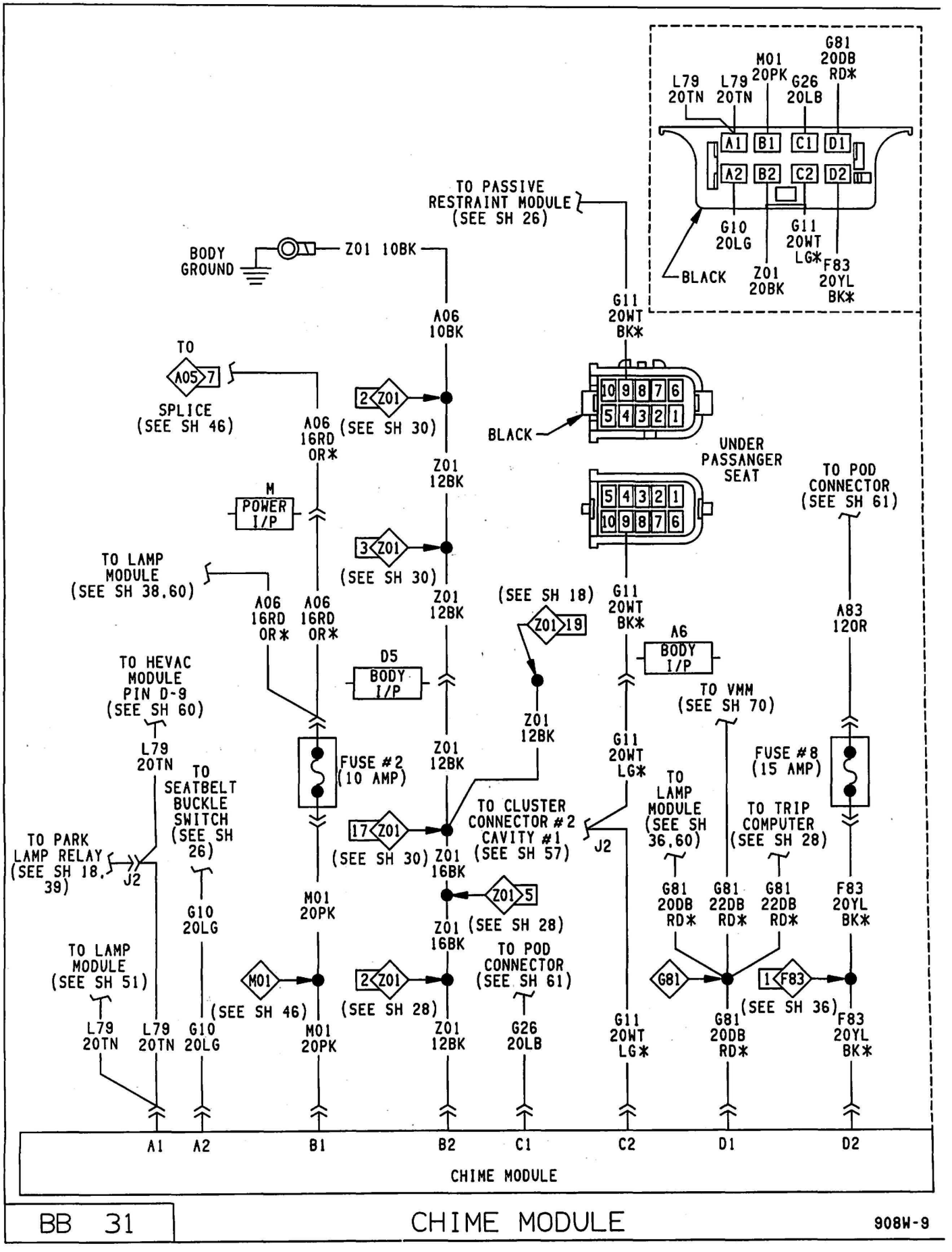
BB 29

DOME & COURTESY LAMP SYSTEM

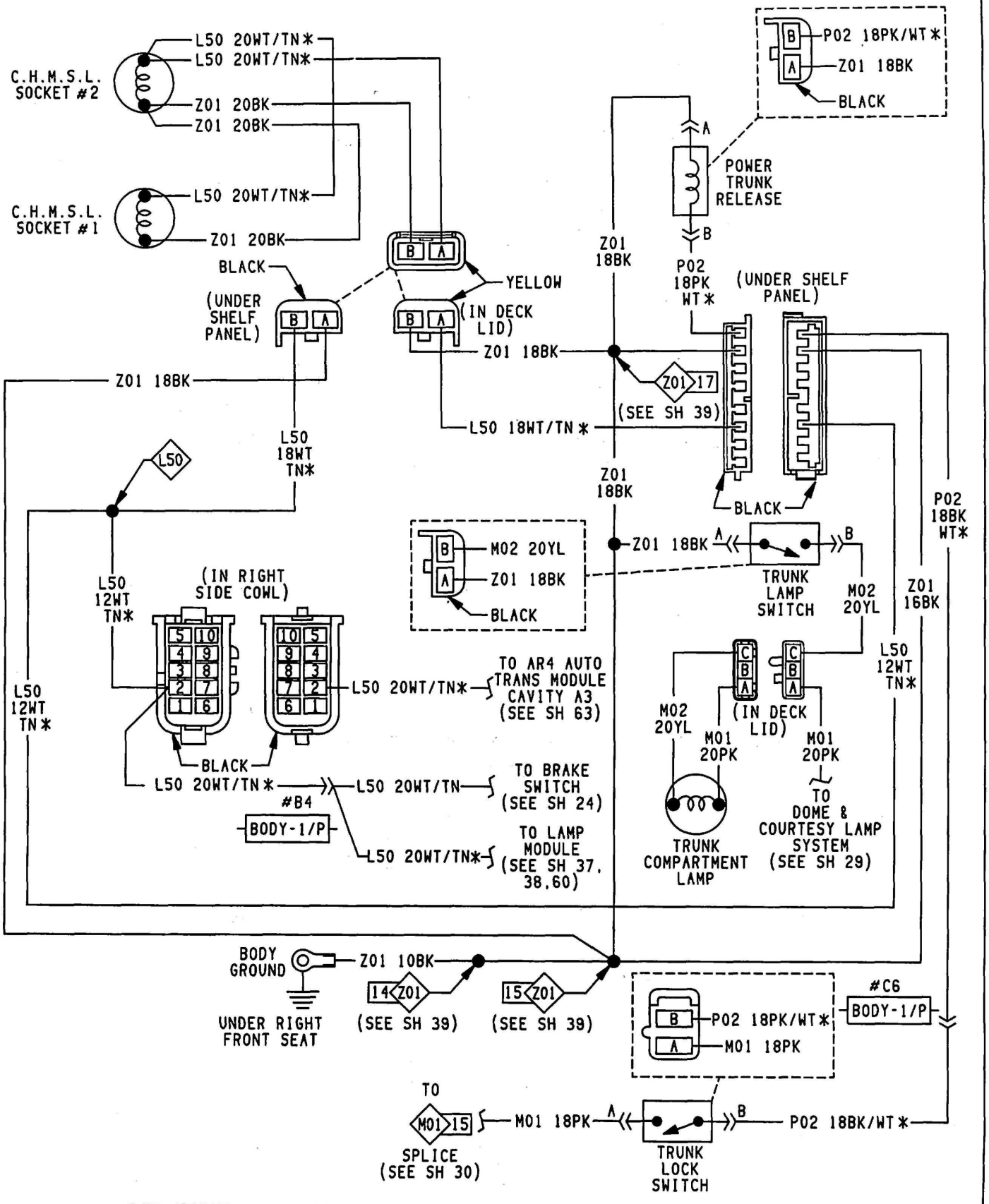
908W-9



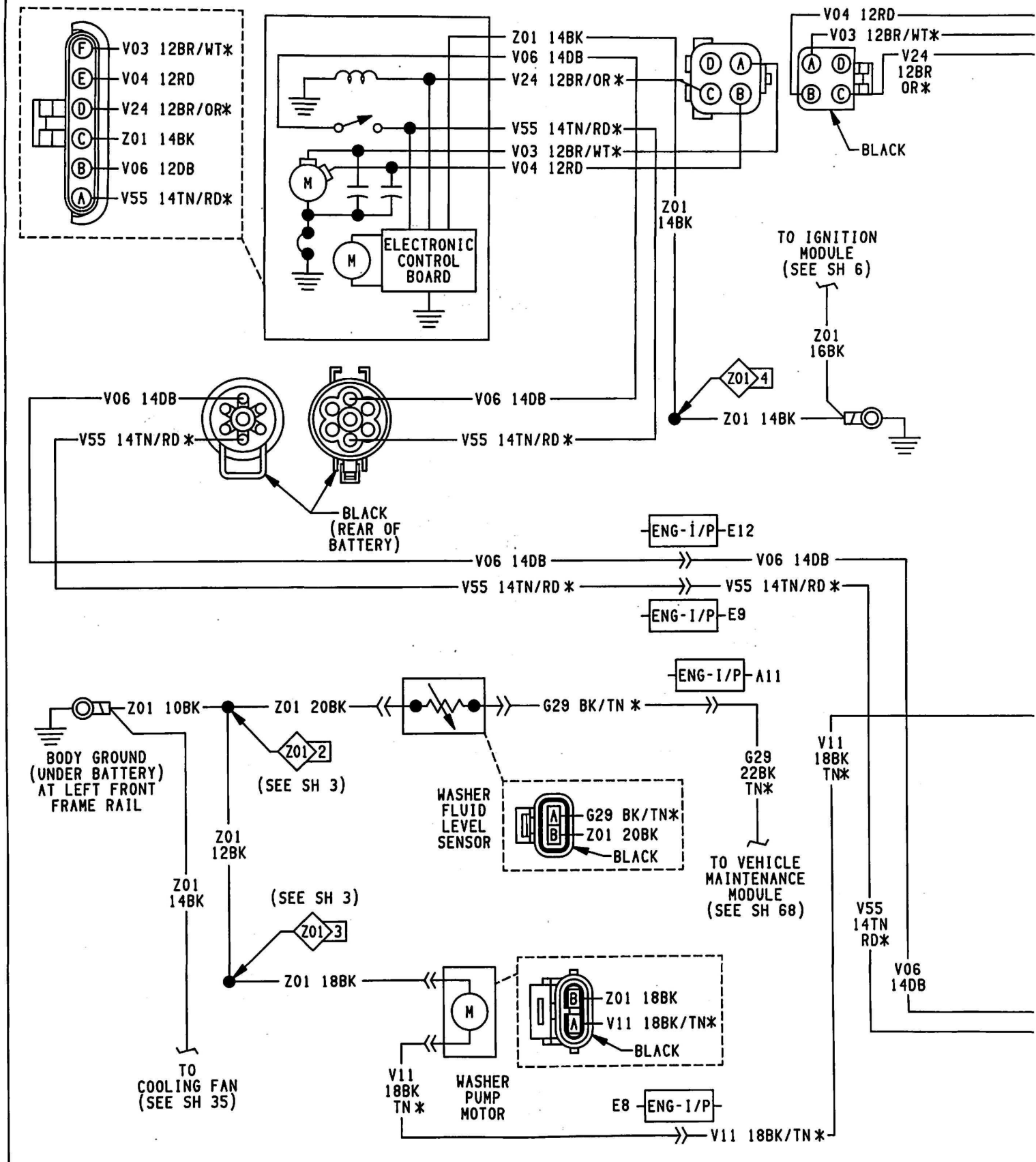
908W-9 DOME & COURTESY LAMP SYSTEM BB 30



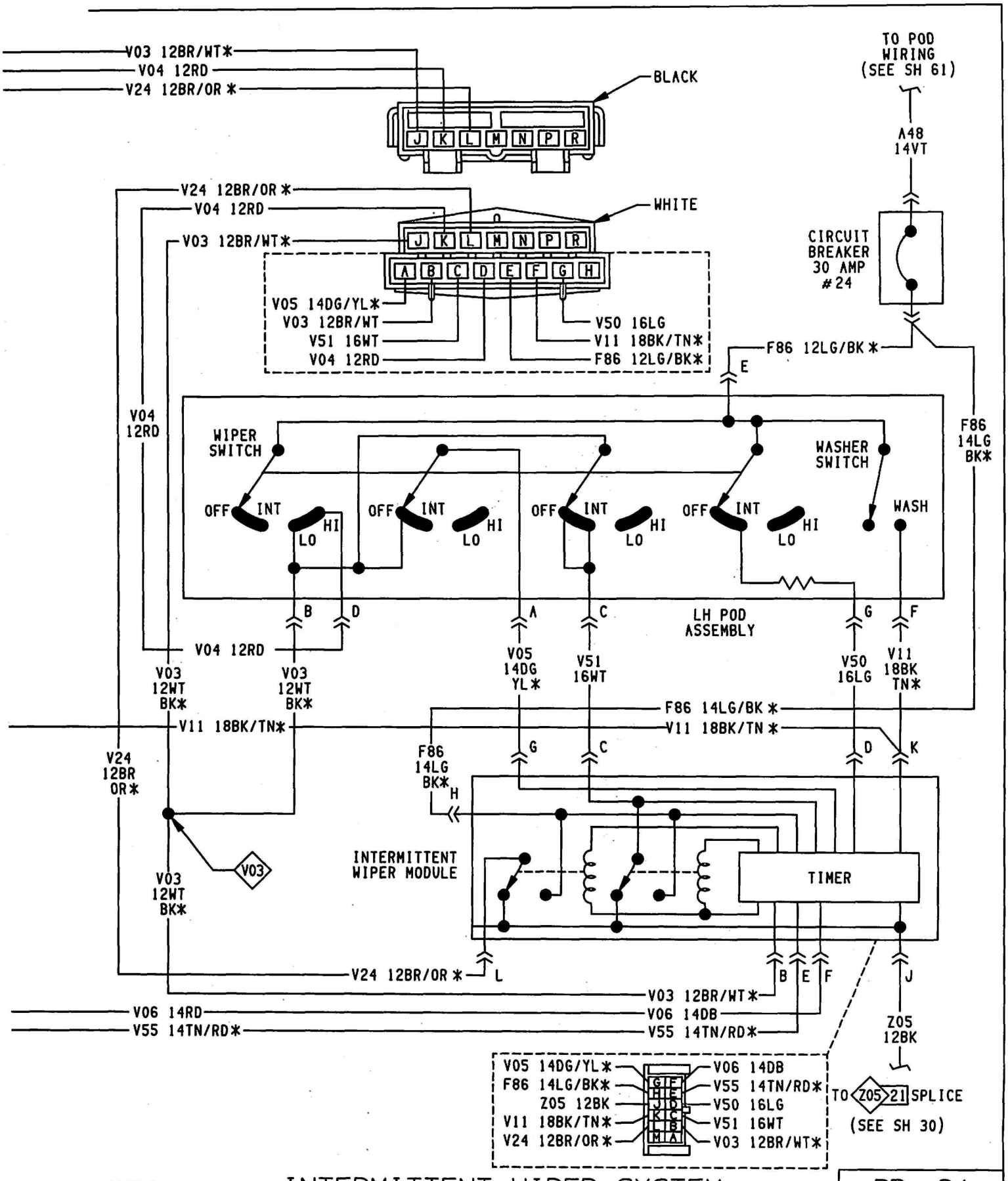
BB 31 CHIME MODULE 908W-9



CENTER HIGH MOUNT STOP LAMP SYSTEM
TRUNK COMPARTMENT LAMP SYSTEM



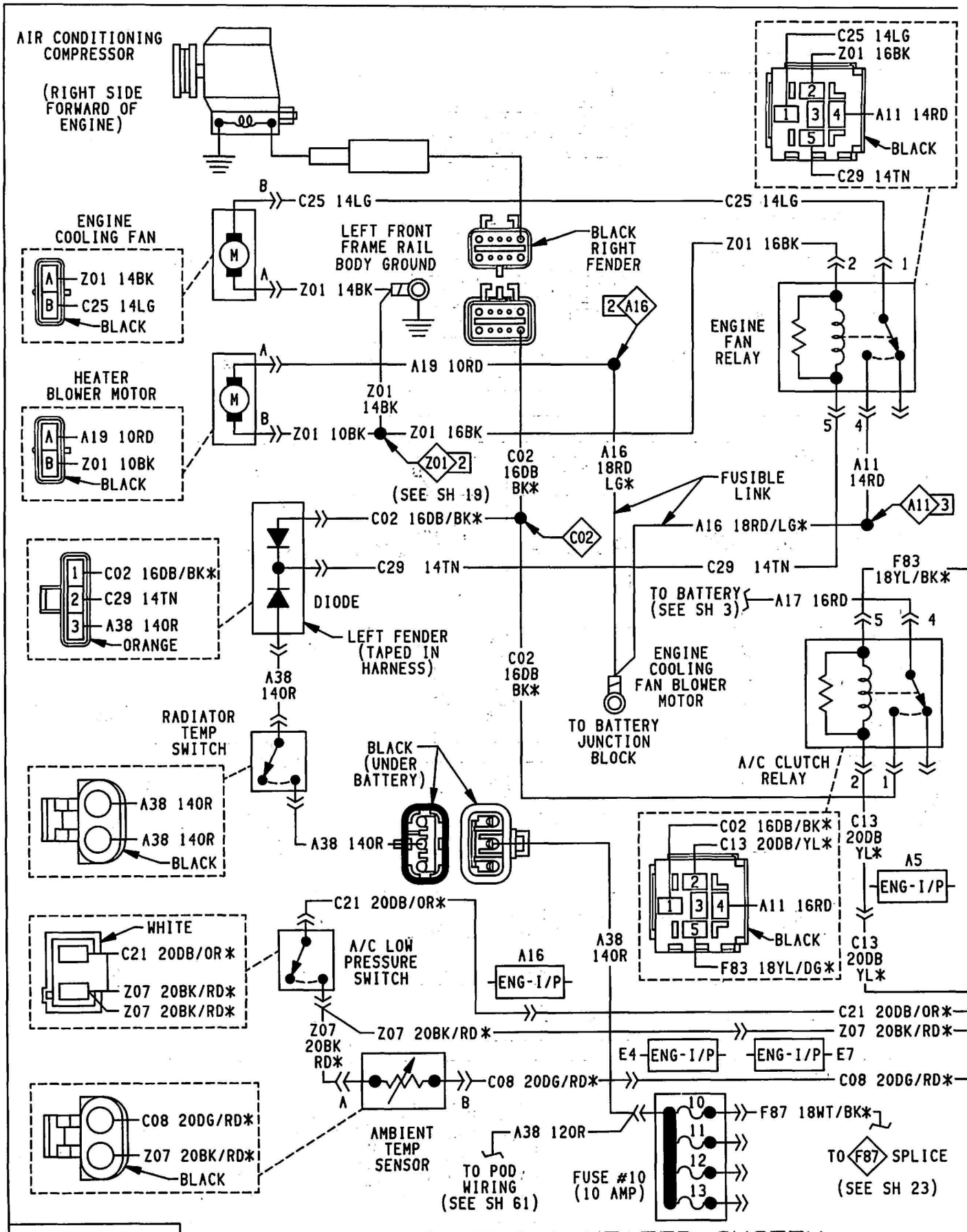
BB 33 INTERMITTENT WIPER SYSTEM 908W-9



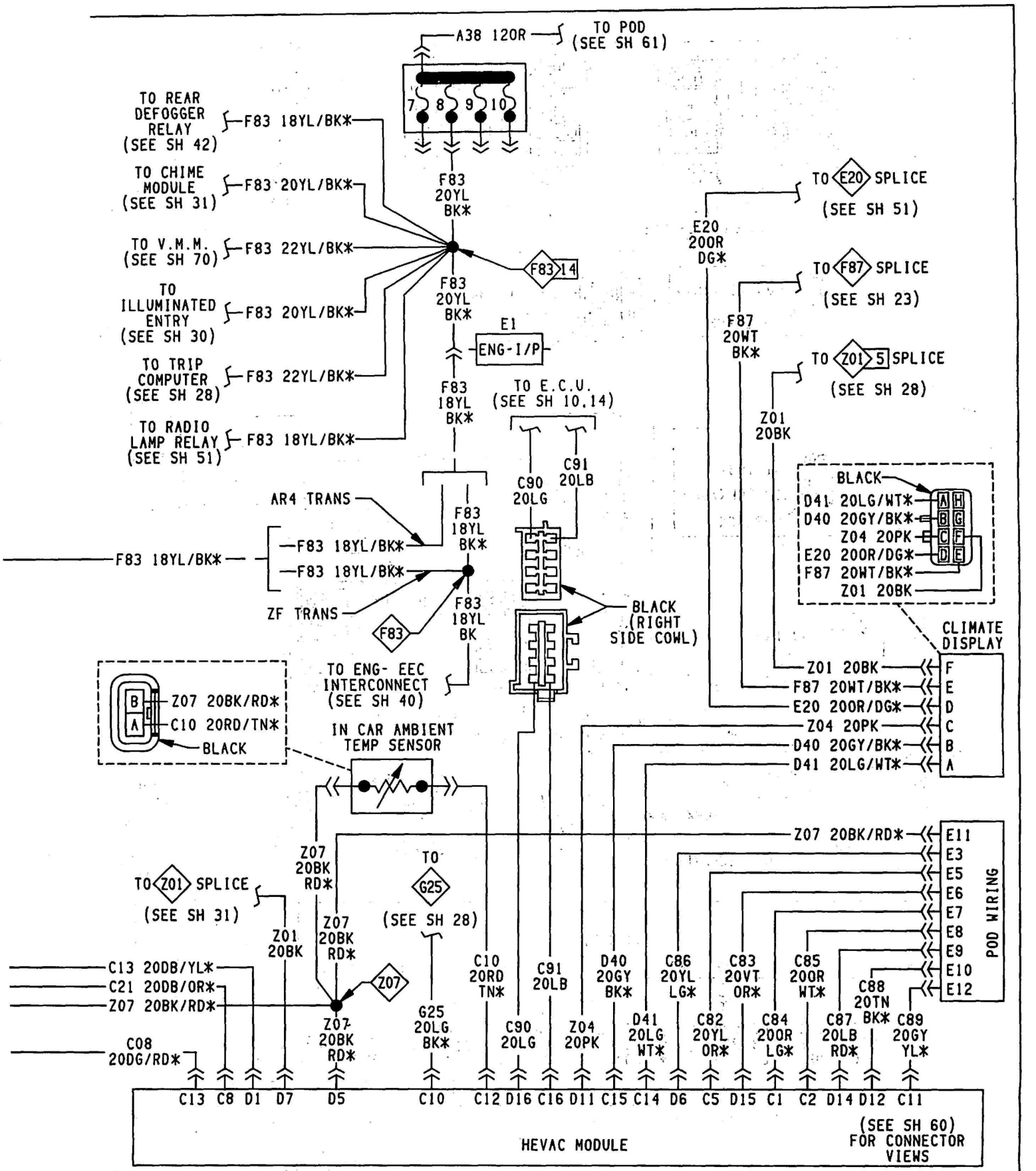
908W-9

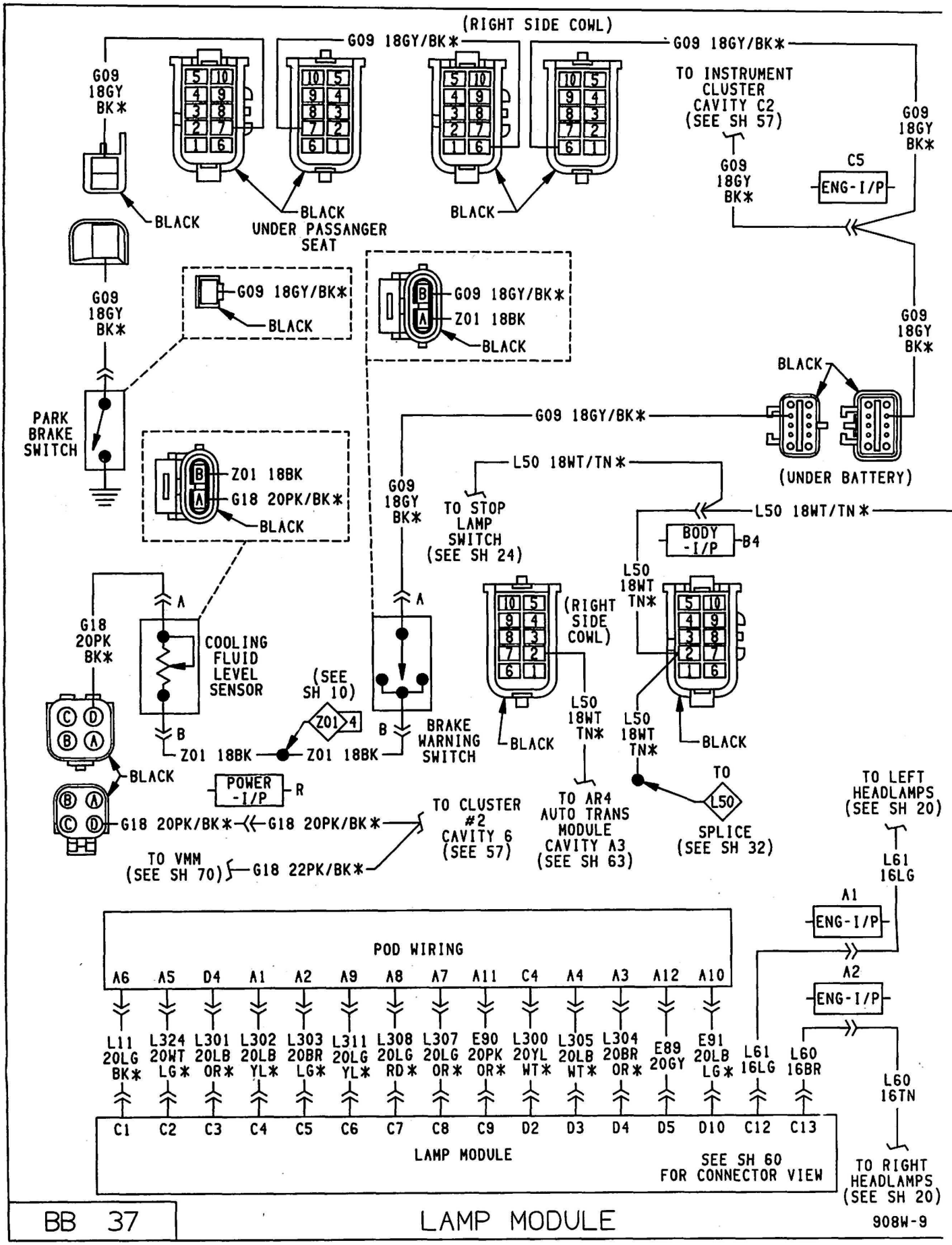
INTERMITTENT WIPER SYSTEM

BB 34

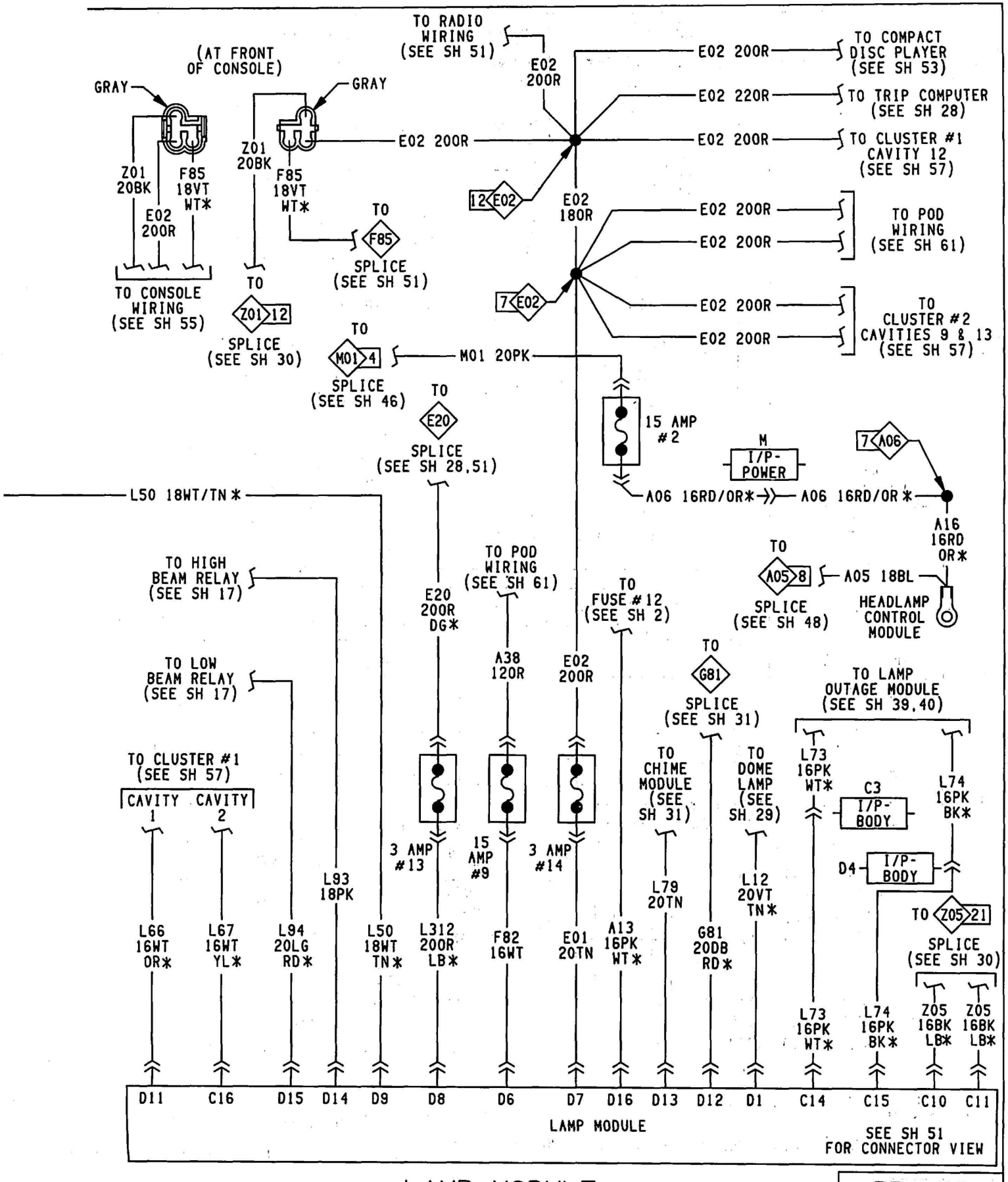


BB 35 AIR CONDITIONING & HEATER SYSTEM 908W-9

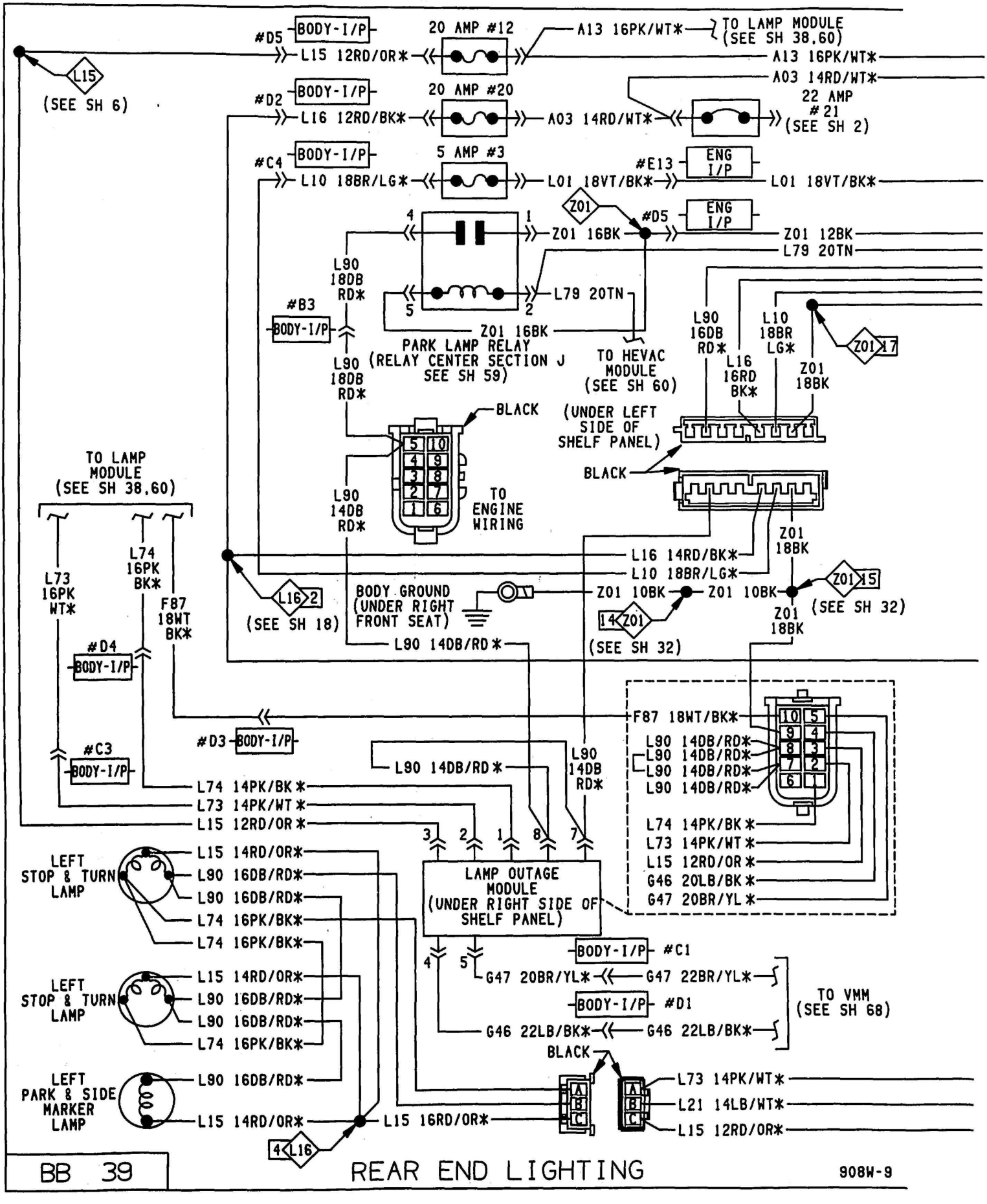

A38 120R
TO POD (SEE SH 61)
7 8 9 10
TO REAR DEFOGGER RELAY (SEE SH 42)
F83 18YL/BK*
TO CHIME MODULE (SEE SH 31)
F83 20YL/BK*
TO V.M.M. (SEE SH 70)
F83 22YL/BK*
TO ILLUMINATED ENTRY (SEE SH 30)
F83 20YL/BK*
TO TRIP COMPUTER (SEE SH 28)
F83 22YL/BK*
TO RADIO LAMP RELAY (SEE SH 51)
F83 18YL/BK*
F83 20YL BK*
F83 14
F83 20YL BK*
E1
ENG-I/P
F83 18YL BK*
TO E.C.U. (SEE SH 10,14)
C90 20LG
C91 20LB
AR4 TRANS
F83 18YL/BK*
F83 18YL BK*
F83 18YL/BK*
F83 18YL/BK*
ZF TRANS
F83
F83 18YL BK
BLACK (RIGHT SIDE COWL)
TO ENG- EEC INTERCONNECT (SEE SH 40)
B
A
Z07 20BK/RD*
C10 20RD/TN*
BLACK
IN CAR AMBIENT TEMP SENSOR
TO E20 SPLICE (SEE SH 51)
E20 200R DG*
TO F87 SPLICE (SEE SH 23)
F87 20WT BK*
TO Z01 5 SPLICE (SEE SH 28)
Z01 20BK
BLACK
D41 20LG/WT*
D40 20GY/BK*
Z04 20PK
E20 200R/DG*
F87 20WT/BK*
Z01 20BK
A H
B G
C F
D E
CLIMATE DISPLAY
Z01 20BK F
F87 20WT/BK* E
E20 200R/DG* D
Z04 20PK C
D40 20GY/BK* B
D41 20LG/WT* A
Z07 20BK/RD*
E11
E3
E5
E6
E7
E8
E9
E10
E12
POD WIRING
TO Z01 SPLICE (SEE SH 31)
Z01 20BK
Z07 20BK RD*
TO G25 (SEE SH 28)
Z07 20BK RD*
Z07
C13 20DB/YL*
C21 20DB/OR*
Z07 20BK/RD*
C08 20DG/RD*
Z07 20BK RD*
G25 20LG BK*
C10 20RD TN*
C91 20LB
C90 20LG
Z04 20PK
D40 20GY BK*
D41 20LG WT*
C86 20YL LG*
C82 20YL OR*
C83 20VT OR*
C84 200R LG*
C85 200R WT*
C87 20LB RD*
C88 20TN BK*
C89 20GY YL*
C13 C8 D1 D7 D5 C10 C12 D16 C16 D11 C15 C14 D6 C5 D15 C1 C2 D14 D12 C11
HEVAC MODULE
(SEE SH 60) FOR CONNECTOR VIEWS



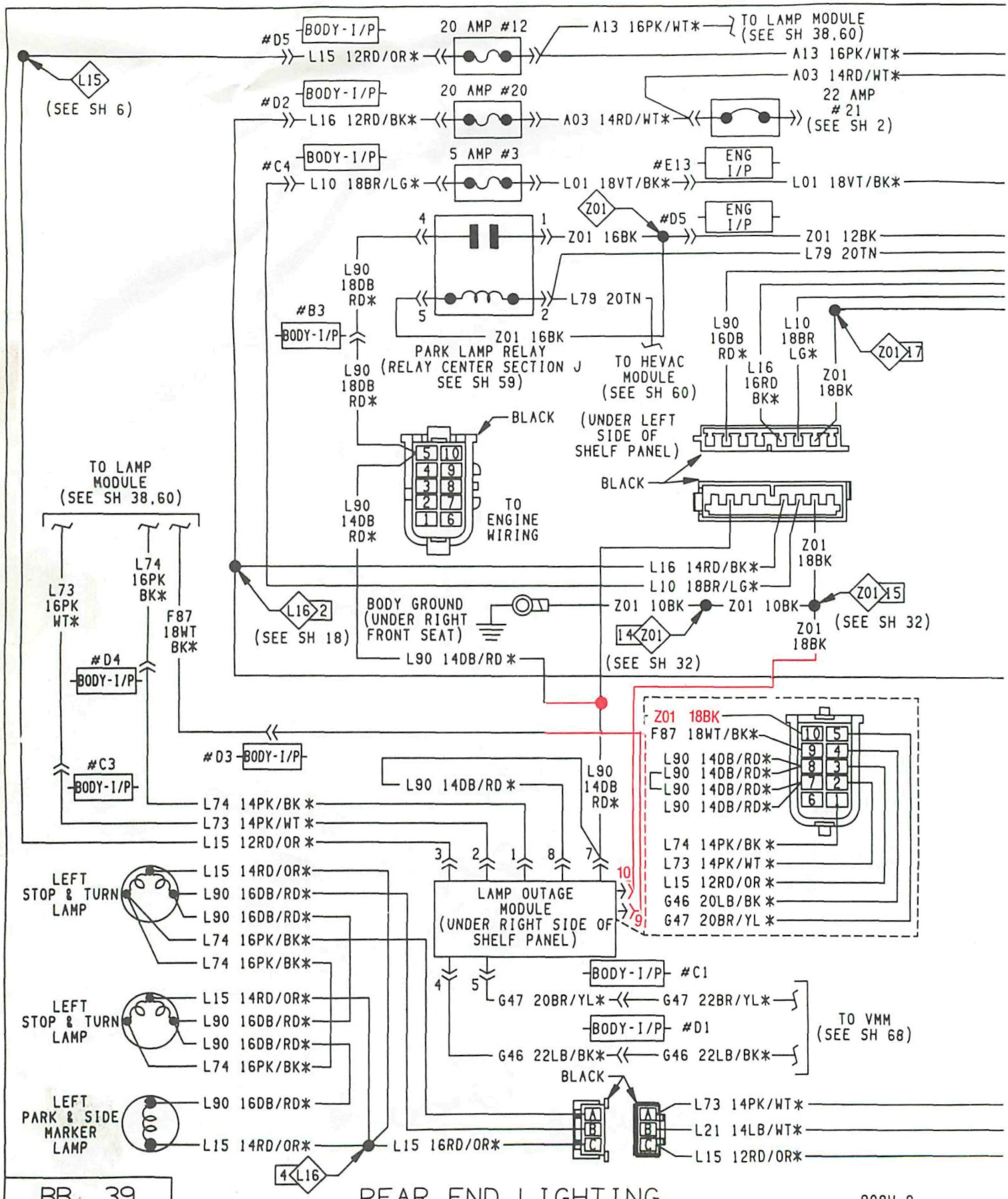
BB 37 LAMP MODULE 908W-9



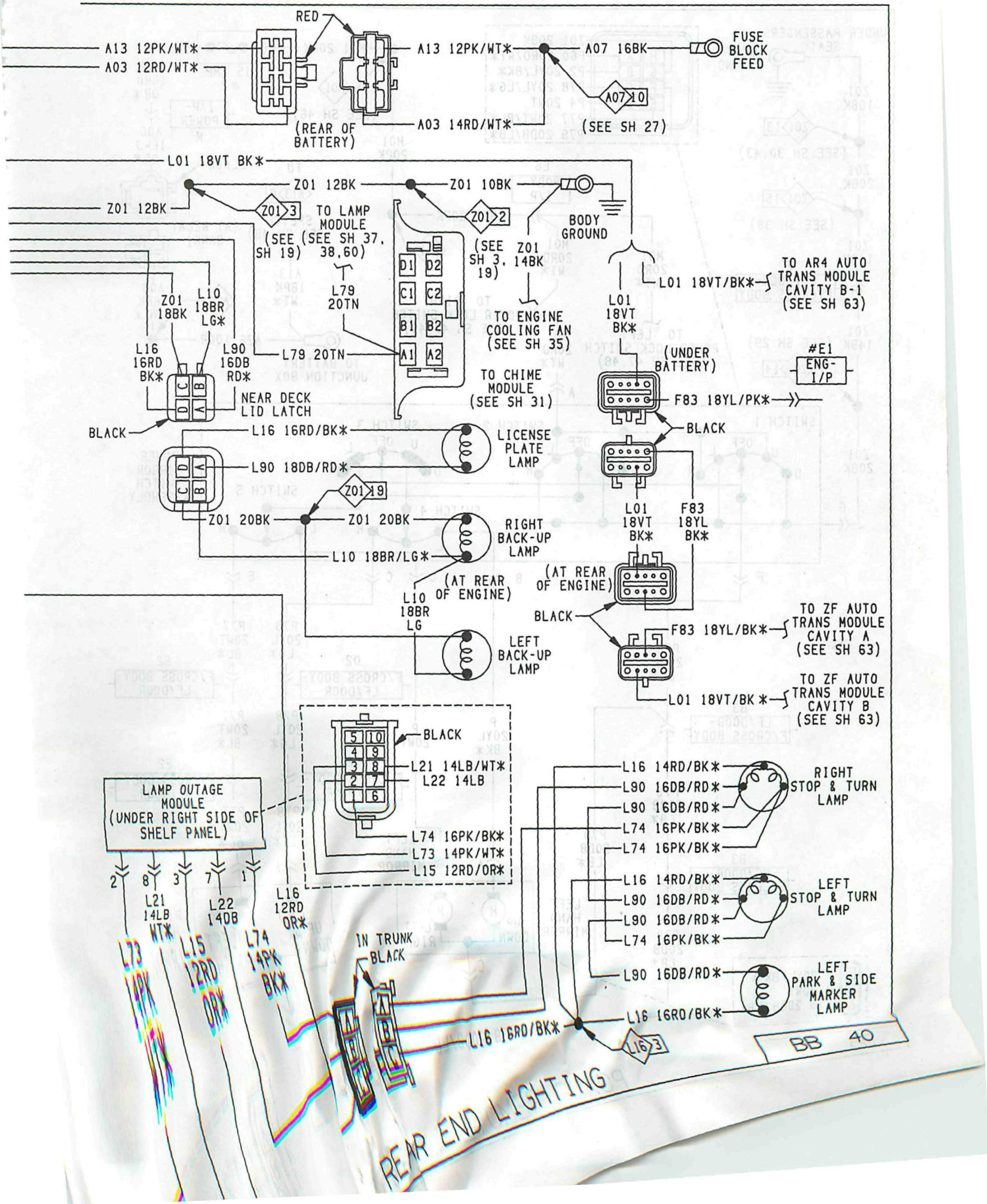
908W-9 LAMP MODULE BB 38

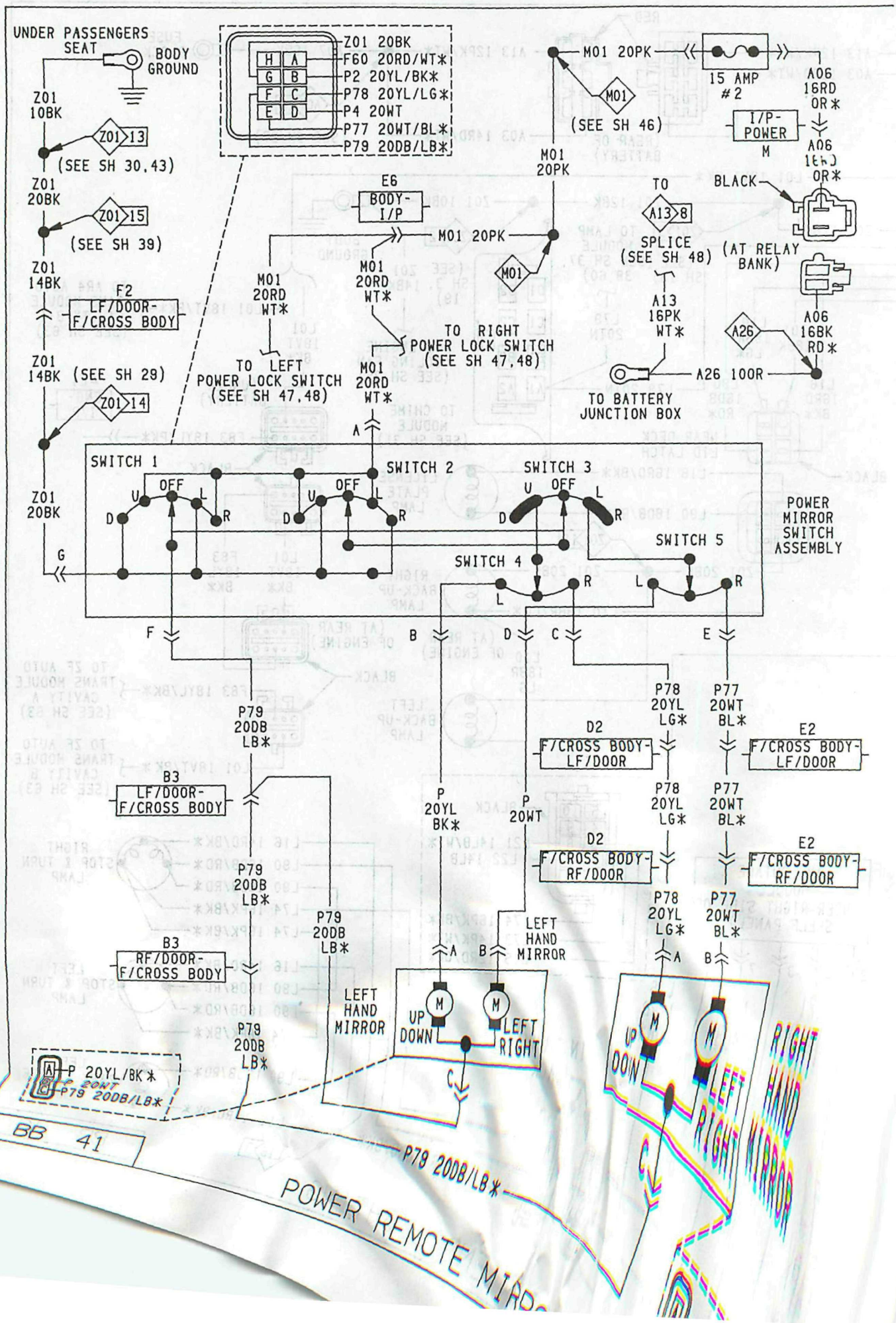


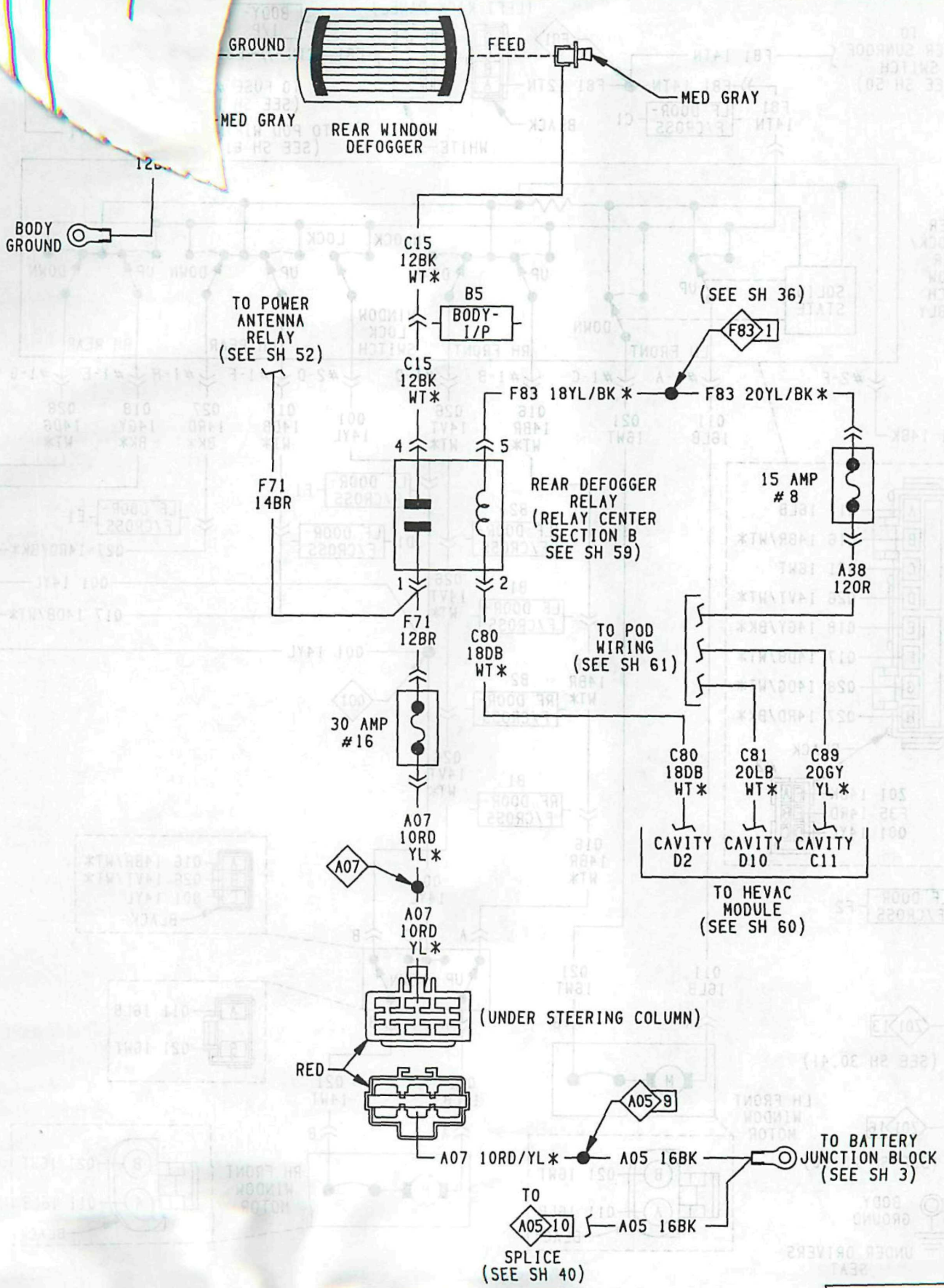
BB 39 REAR END LIGHTING 908W-9



BB 39 REAR END LIGHTING 908W-9

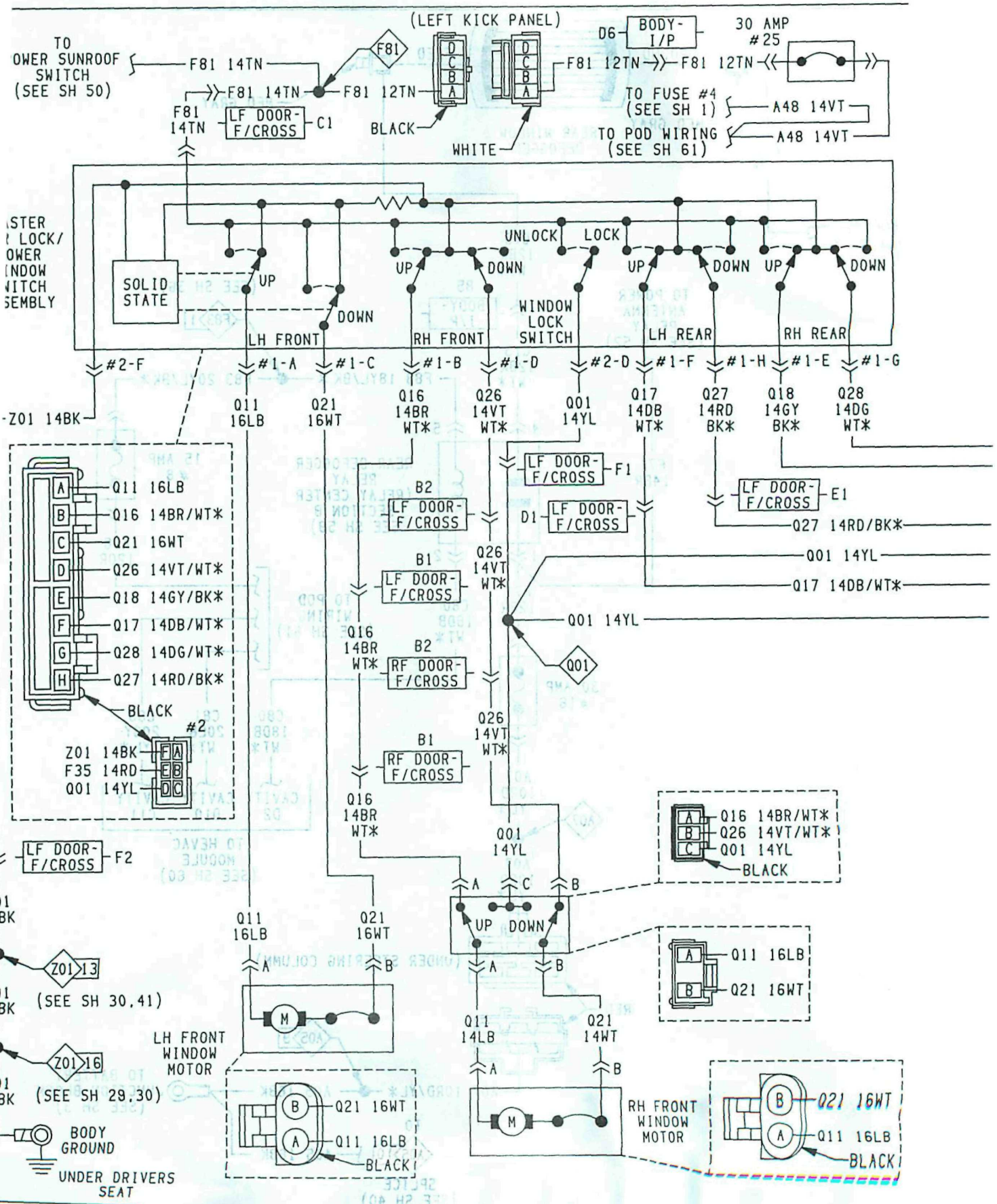

RED
A13 12PK/WT*
A03 12RD/WT*
A13 12PK/WT*
A07 16BK
FUSE BLOCK FEED
A07 10
(SEE SH 27)
A03 14RD/WT*
(REAR OF BATTERY)
L01 18VT BK*
Z01 12BK
Z01 10BK
BODY GROUND
Z01 12BK
Z01 3
TO LAMP MODULE (SEE SH 19)
(SEE SH 37, 38, 60)
Z01 2
(SEE SH 3, 19)
Z01 14BK
L79 20TN
TO ENGINE COOLING FAN (SEE SH 35)
TO CHIME MODULE (SEE SH 31)
L01 18VT BK*
L01 18VT/BK*
TO AR4 AUTO TRANS MODULE CAVITY B-1 (SEE SH 63)
Z01 18BK
L10 18BR LG*
L16 16RD BK*
L90 16DB RD*
L79 20TN
NEAR DECK LID LATCH
(UNDER BATTERY)
#E1 ENG-I/P
F83 18YL/PK*
BLACK
L16 16RD/BK*
L90 18DB/RD*
LICENSE PLATE LAMP
Z01 19
Z01 20BK
Z01 20BK
RIGHT BACK-UP LAMP
L10 18BR/LG*
(AT REAR OF ENGINE)
L10 18BR LG
LEFT BACK-UP LAMP
L01 18VT BK*
F83 18YL BK*
(AT REAR OF ENGINE)
BLACK
F83 18YL/BK*
TO ZF AUTO TRANS MODULE CAVITY A (SEE SH 63)
L01 18VT/BK*
TO ZF AUTO TRANS MODULE CAVITY B (SEE SH 63)
BLACK
L21 14LB/WT*
L22 14LB
L74 16PK/BK*
L73 14PK/WT*
L15 12RD/OR*
LAMP OUTAGE MODULE (UNDER RIGHT SIDE OF SHELF PANEL)
2
8
3
7
1
L21 14LB WT*
L22 14DB
L16 12RD OR*
L73 14PK WT*
L15 12RD OR*
L74 14PK BK*
IN TRUNK
BLACK
L16 14RD/BK*
L90 16DB/RD*
L90 16DB/RD*
L74 16PK/BK*
L74 16PK/BK*
RIGHT STOP & TURN LAMP
L16 14RD/BK*
L90 16DB/RD*
L90 16DB/RD*
L74 16PK/BK*
LEFT STOP & TURN LAMP
L90 16DB/RD*
LEFT PARK & SIDE MARKER LAMP
L16 16RD/BK*
L16 16RD/BK*
L16 3
BB 40
REAR END LIGHTING

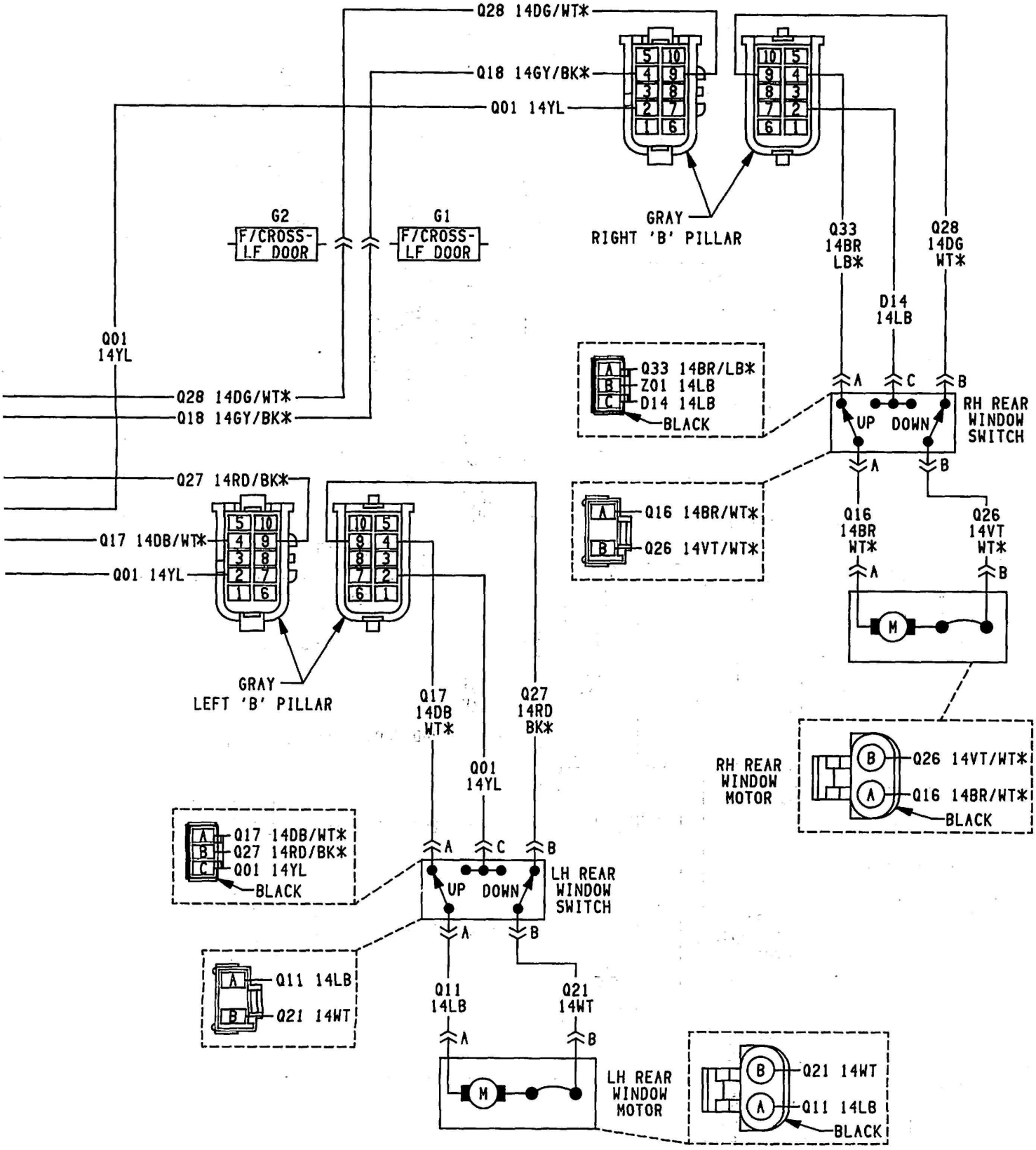

UNDER PASSENGERS SEAT
BODY GROUND
Z01 10BK
Z01 13
(SEE SH 30,43)
Z01 20BK
Z01 15
(SEE SH 39)
Z01 14BK
F2
LF/DOOR-F/CROSS BODY
Z01 14BK (SEE SH 29)
Z01 14
Z01 20BK
G
H A
G B
F C
E D
Z01 20BK
F60 20RD/WT*
P2 20YL/BK*
P78 20YL/LG*
P4 20WT
P77 20WT/BL*
P79 20DB/LB*
M01 20PK
M01
(SEE SH 46)
15 AMP #2
A06 16RD OR*
I/P-POWER M
A06 16BK OR*
BLACK
TO A13 8
SPLICE (SEE SH 48)
(AT RELAY BANK)
A13 16PK WT*
A26
A06 16BK RD*
A26 100R
TO BATTERY JUNCTION BOX
E6
BODY-I/P
M01 20PK
M01 20RD WT*
TO LEFT POWER LOCK SWITCH (SEE SH 47,48)
M01 20RD WT*
TO RIGHT POWER LOCK SWITCH (SEE SH 47,48)
M01 20RD WT*
A
SWITCH 1
SWITCH 2
SWITCH 3
SWITCH 4
SWITCH 5
U OFF L
D R
POWER MIRROR SWITCH ASSEMBLY
F
B
D
C
E
P79 20DB LB*
B3
LF/DOOR-F/CROSS BODY
P79 20DB LB*
B3
RF/DOOR-F/CROSS BODY
P79 20DB LB*
P79 20DB LB*
P 20YL BK*
P 20WT
P78 20YL LG*
P77 20WT BL*
D2
F/CROSS BODY-LF/DOOR
E2
F/CROSS BODY-LF/DOOR
D2
F/CROSS BODY-RF/DOOR
E2
F/CROSS BODY-RF/DOOR
LEFT HAND MIRROR
A
B
LEFT HAND MIRROR
UP DOWN
LEFT RIGHT
M
C
RIGHT HAND MIRROR
P 20YL/BK*
P 20WT
P79 20DB/LB*
P79 20DB/LB*
POWER REMOTE MIRR



REAR WINDOW DEFOGGER

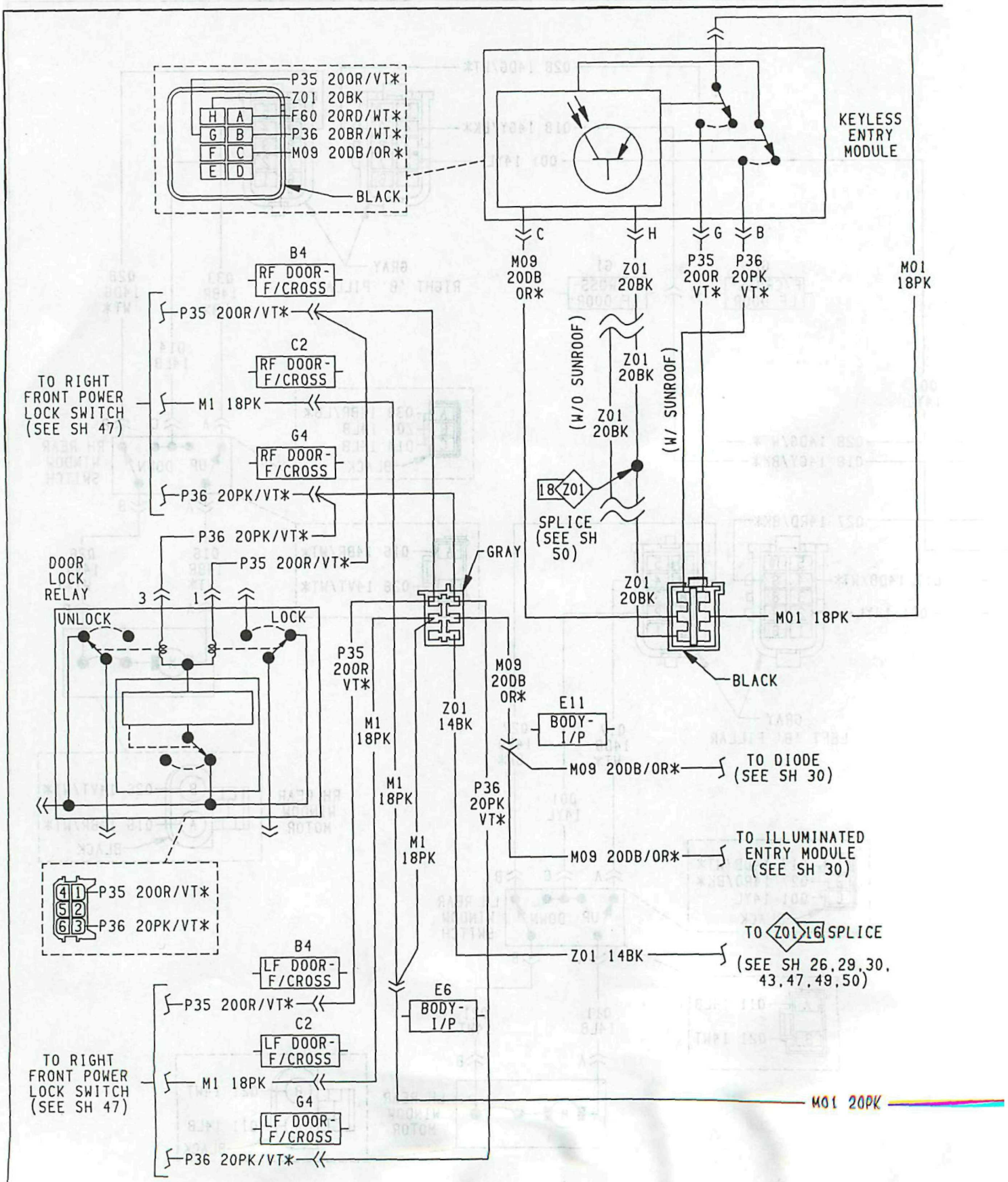
BB 42


(LEFT KICK PANEL)
TO POWER SUNROOF SWITCH (SEE SH 50)
F81 14TN
F81
F81 14TN
F81 12TN
LF DOOR-F/CROSS C1
BLACK
WHITE
F81 12TN
F81 12TN
D6 BODY-I/P
30 AMP #25
TO FUSE #4 (SEE SH 1)
A48 14VT
TO POD WIRING (SEE SH 61)
A48 14VT
SOLID STATE
UP
DOWN
UNLOCK
LOCK
WINDOW LOCK SWITCH
LH FRONT
RH FRONT
LH REAR
RH REAR
#2-F
#1-A
#1-C
#1-B
#1-D
#2-D
#1-F
#1-H
#1-E
#1-G
Z01 14BK
Q11 16LB
Q21 16WT
Q16 14BR WT*
Q26 14VT WT*
Q01 14YL
Q17 14DB WT*
Q27 14RD BK*
Q18 14GY BK*
Q28 14DG WT*
LF DOOR-F/CROSS F1
LF DOOR-F/CROSS E1
B2
LF DOOR-F/CROSS
D1 LF DOOR-F/CROSS
Q27 14RD/BK*
B1
LF DOOR-F/CROSS
Q01 14YL
Q17 14DB/WT*
Q01 14YL
Q01
B2
RF DOOR-F/CROSS
B1
RF DOOR-F/CROSS
Q11 16LB
Q16 14BR/WT*
Q26 14VT/WT*
Q01 14YL
BLACK
#2
Z01 14BK
F35 14RD
Q01 14YL
LF DOOR-F/CROSS F2
Z01 13
(SEE SH 30,41)
Z01 16
(SEE SH 29,30)
BODY GROUND
UNDER DRIVERS SEAT
LH FRONT WINDOW MOTOR
RH FRONT WINDOW MOTOR
Q21 16WT
Q11 16LB
BLACK
Q11 14LB
Q21 14WT
Q11 16LB
Q21 16WT
BLACK



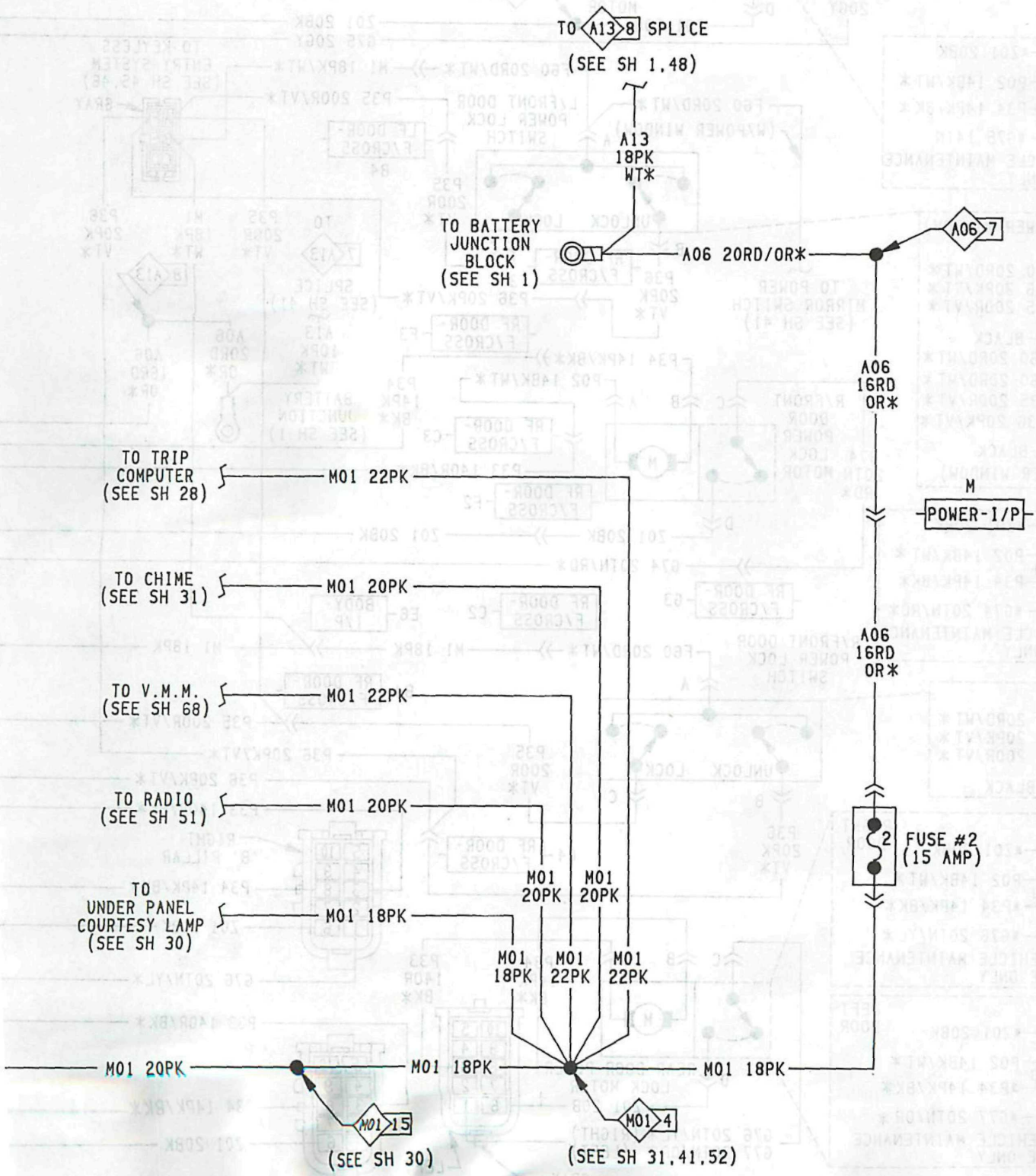
POWER WINDOWS

BB 44



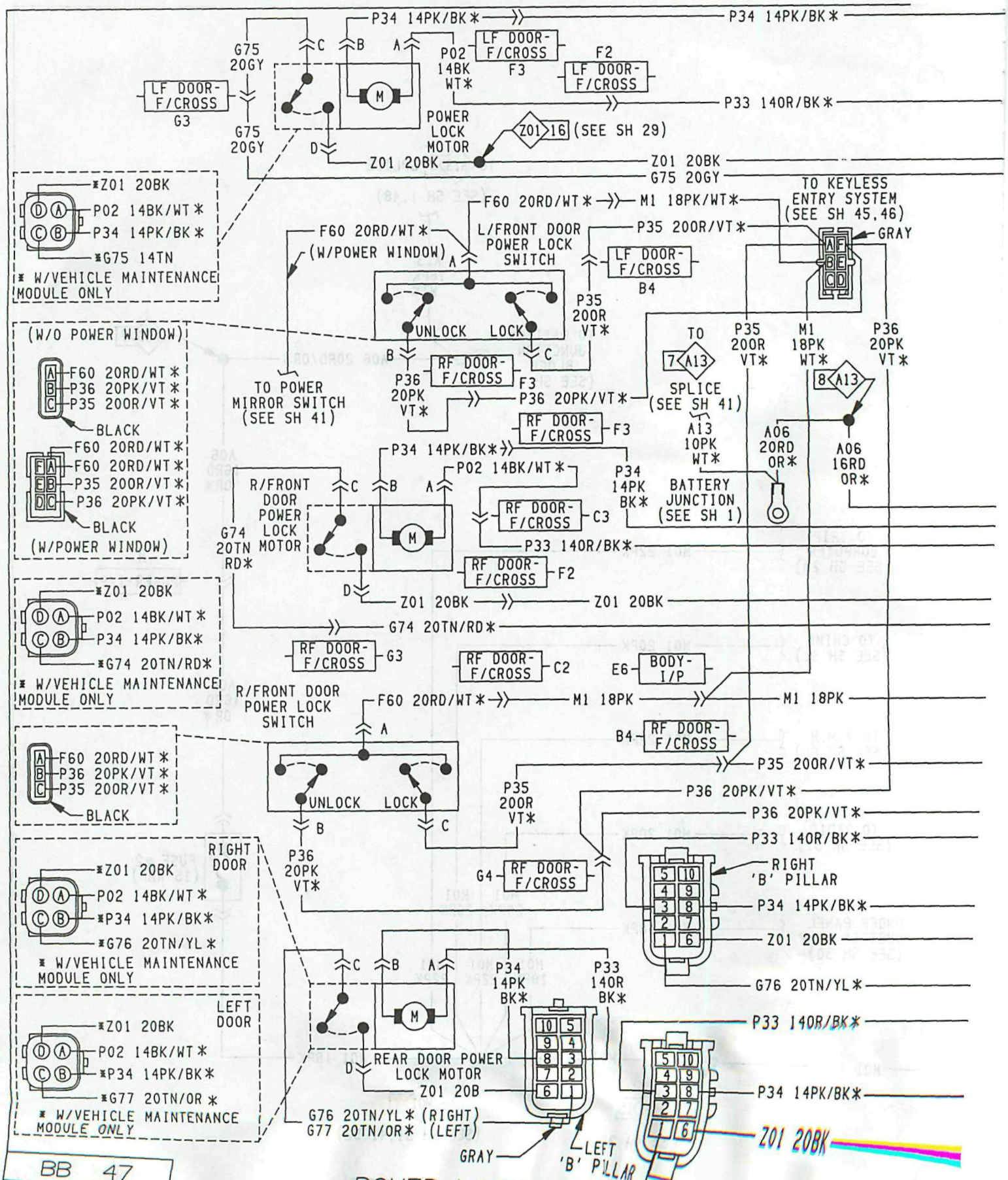
BB 45

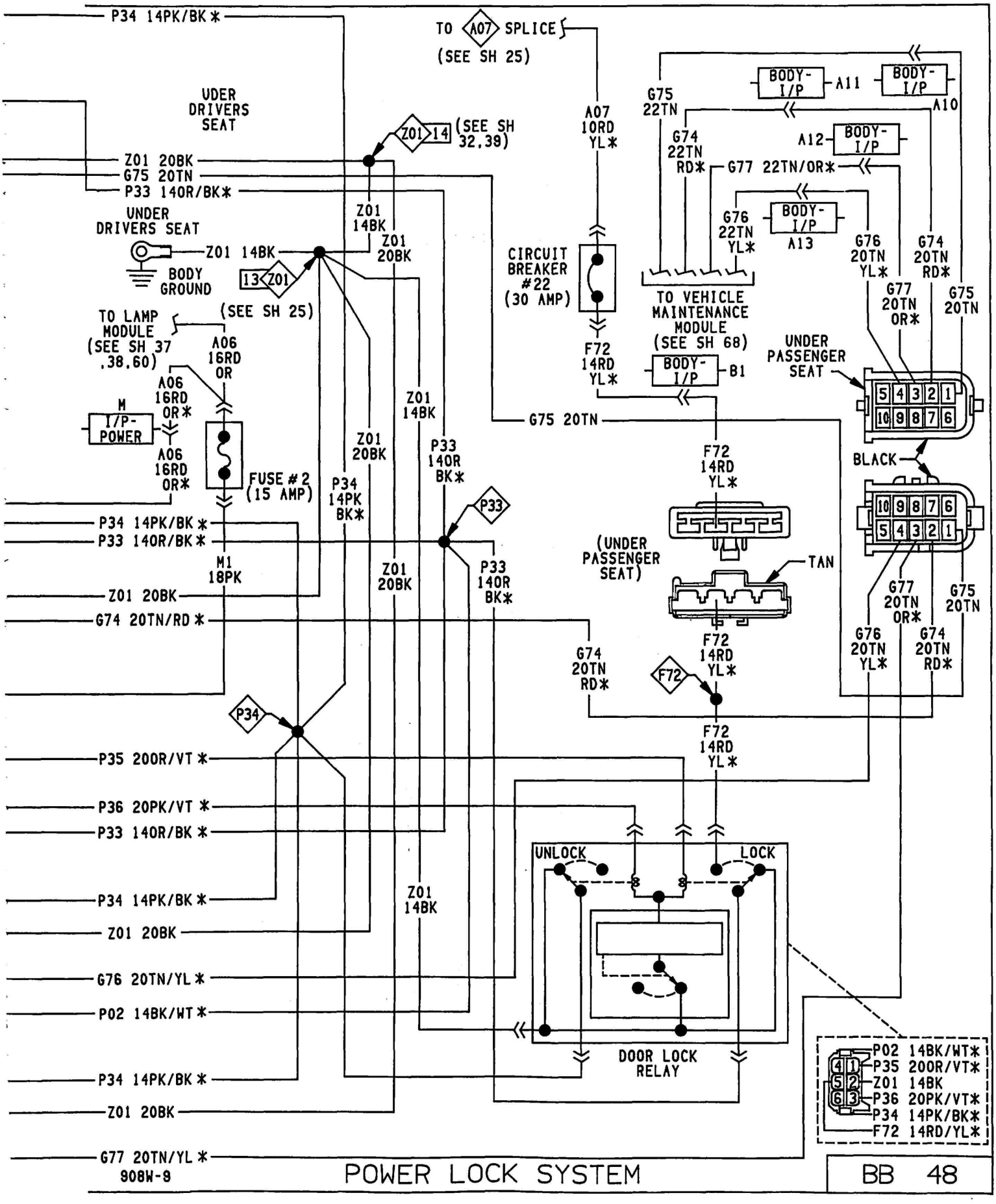
KEYLESS ENTRY SYSTEM



KEYLESS ENTRY SYSTEM

BB 46

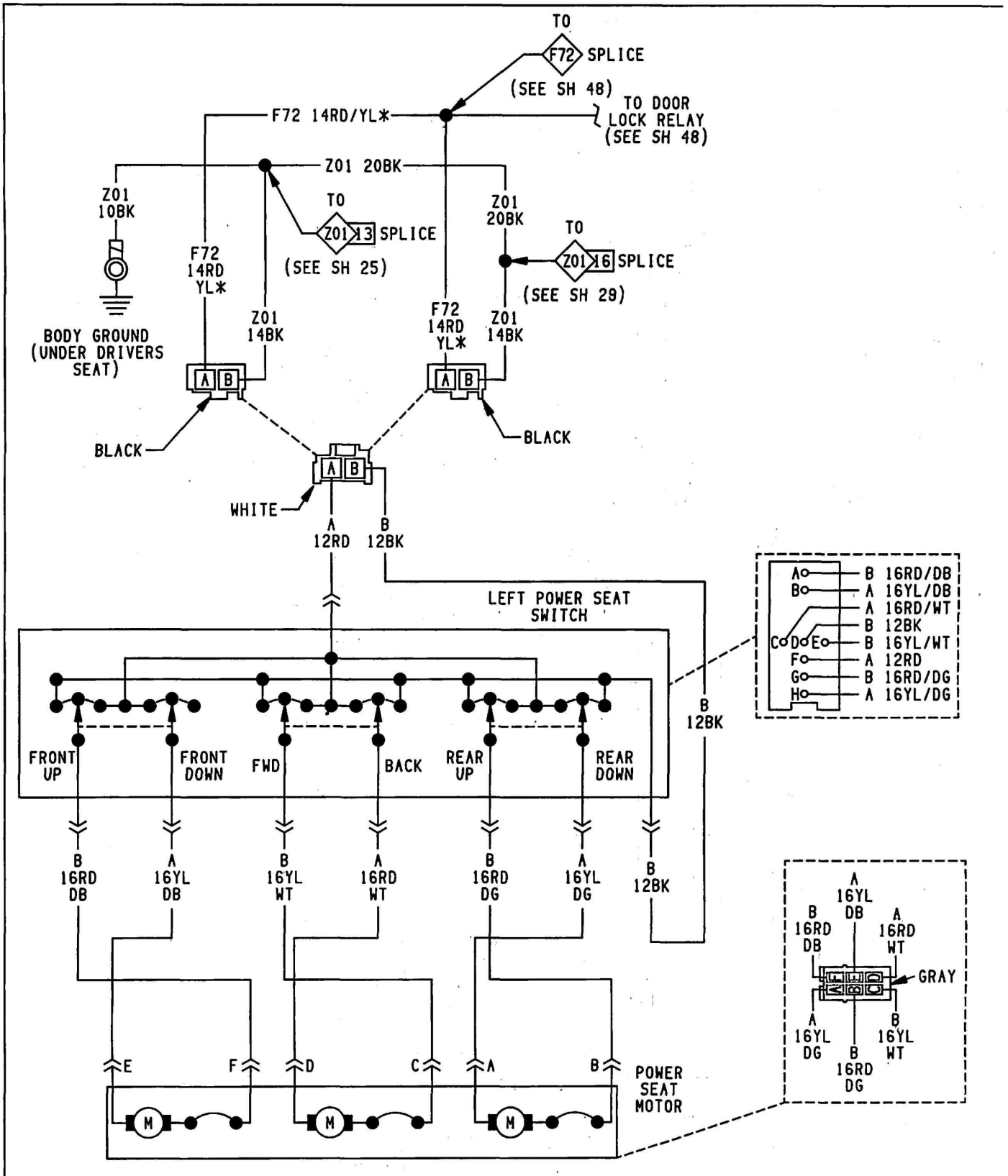

P34 14PK/BK*
P34 14PK/BK*
G75 20GY
C
B
A
P02 14BK WT*
LF DOOR-F/CROSS F3
F2
LF DOOR-F/CROSS
LF DOOR-F/CROSS G3
P33 14OR/BK*
G75 20GY
POWER LOCK MOTOR
Z01 16 (SEE SH 29)
D
Z01 20BK
Z01 20BK
G75 20GY
*Z01 20BK
P02 14BK/WT*
P34 14PK/BK*
*G75 14TN
* W/VEHICLE MAINTENANCE MODULE ONLY
F60 20RD/WT*
M1 18PK/WT*
TO KEYLESS ENTRY SYSTEM (SEE SH 45,46)
GRAY
F60 20RD/WT*
(W/POWER WINDOW)
L/FRONT DOOR POWER LOCK SWITCH
P35 20OR/VT*
LF DOOR-F/CROSS B4
A
UNLOCK
LOCK
P35 20OR VT*
(W/O POWER WINDOW)
F60 20RD/WT*
P36 20PK/VT*
P35 20OR/VT*
BLACK
B
RF DOOR-F/CROSS F3
C
TO POWER MIRROR SWITCH (SEE SH 41)
P36 20PK VT*
P36 20PK/VT*
TO 7 A13 SPLICE (SEE SH 41)
P35 20OR VT*
M1 18PK WT*
8 A13
P36 20PK VT*
RF DOOR-F/CROSS F3
A13 10PK WT*
A06 20RD OR*
A06 16RD OR*
F60 20RD/WT*
F60 20RD/WT*
P35 20OR/VT*
P36 20PK/VT*
BLACK
(W/POWER WINDOW)
P34 14PK/BK*
P02 14BK/WT*
R/FRONT DOOR POWER LOCK MOTOR
G74 20TN RD*
C
B
A
P34 14PK BK*
RF DOOR-F/CROSS C3
BATTERY JUNCTION (SEE SH 1)
P33 14OR/BK*
RF DOOR-F/CROSS F2
D
Z01 20BK
Z01 20BK
*Z01 20BK
P02 14BK/WT*
P34 14PK/BK*
G74 20TN/RD
* W/VEHICLE MAINTENANCE MODULE ONLY
G74 20TN/RD*
RF DOOR-F/CROSS G3
RF DOOR-F/CROSS C2
E6 BODY-I/P
R/FRONT DOOR POWER LOCK SWITCH
F60 20RD/WT*
M1 18PK
M1 18PK
A
B4 RF DOOR-F/CROSS
P35 20OR/VT*
F60 20RD/WT*
P36 20PK/VT*
P36 20PK/VT*
UNLOCK
LOCK
P35 20OR VT*
P36 20PK/VT*
P33 14OR/BK*
B
C
P36 20PK VT*
G4 RF DOOR-F/CROSS
RIGHT 'B' PILLAR
P34 14PK/BK*
Z01 20BK
RIGHT DOOR
*Z01 20BK
P02 14BK/WT*
P34 14PK/BK
G76 20TN/YL
* W/VEHICLE MAINTENANCE MODULE ONLY
G76 20TN/YL*
C
B
A
P34 14PK BK*
P33 14OR BK*
P33 14OR/BK*
LEFT DOOR
*Z01 20BK
P02 14BK/WT*
P34 14PK/BK
G77 20TN/OR
* W/VEHICLE MAINTENANCE MODULE ONLY
REAR DOOR POWER LOCK MOTOR
D
Z01 20B
P34 14PK/BK*
G76 20TN/YL* (RIGHT)
G77 20TN/OR* (LEFT)
GRAY
LEFT 'B' PILLAR
Z01 20BK
G77 20TN/YL*
BB 47
POWER LOCK SYSTEM



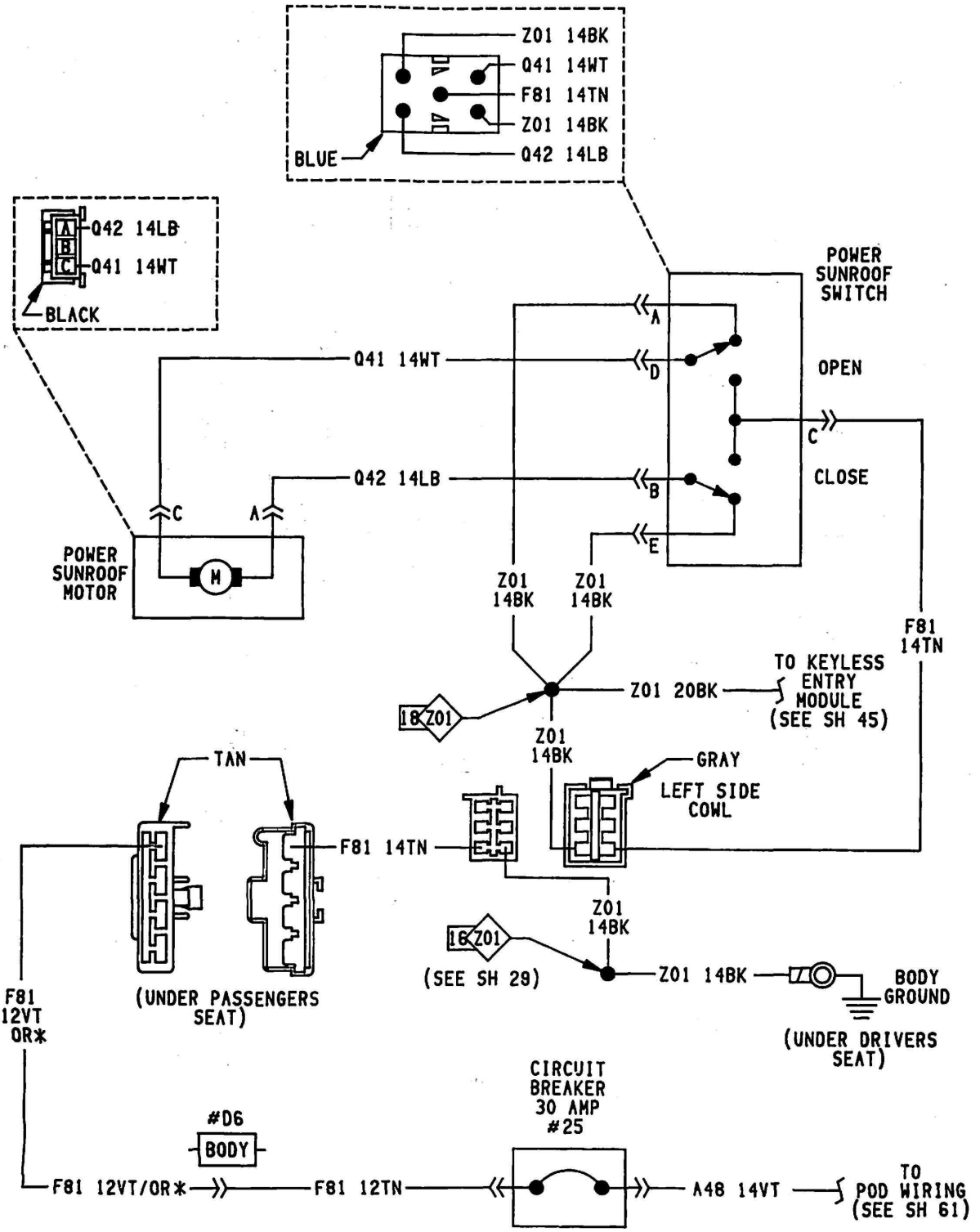
908W-9

POWER LOCK SYSTEM

BB 48

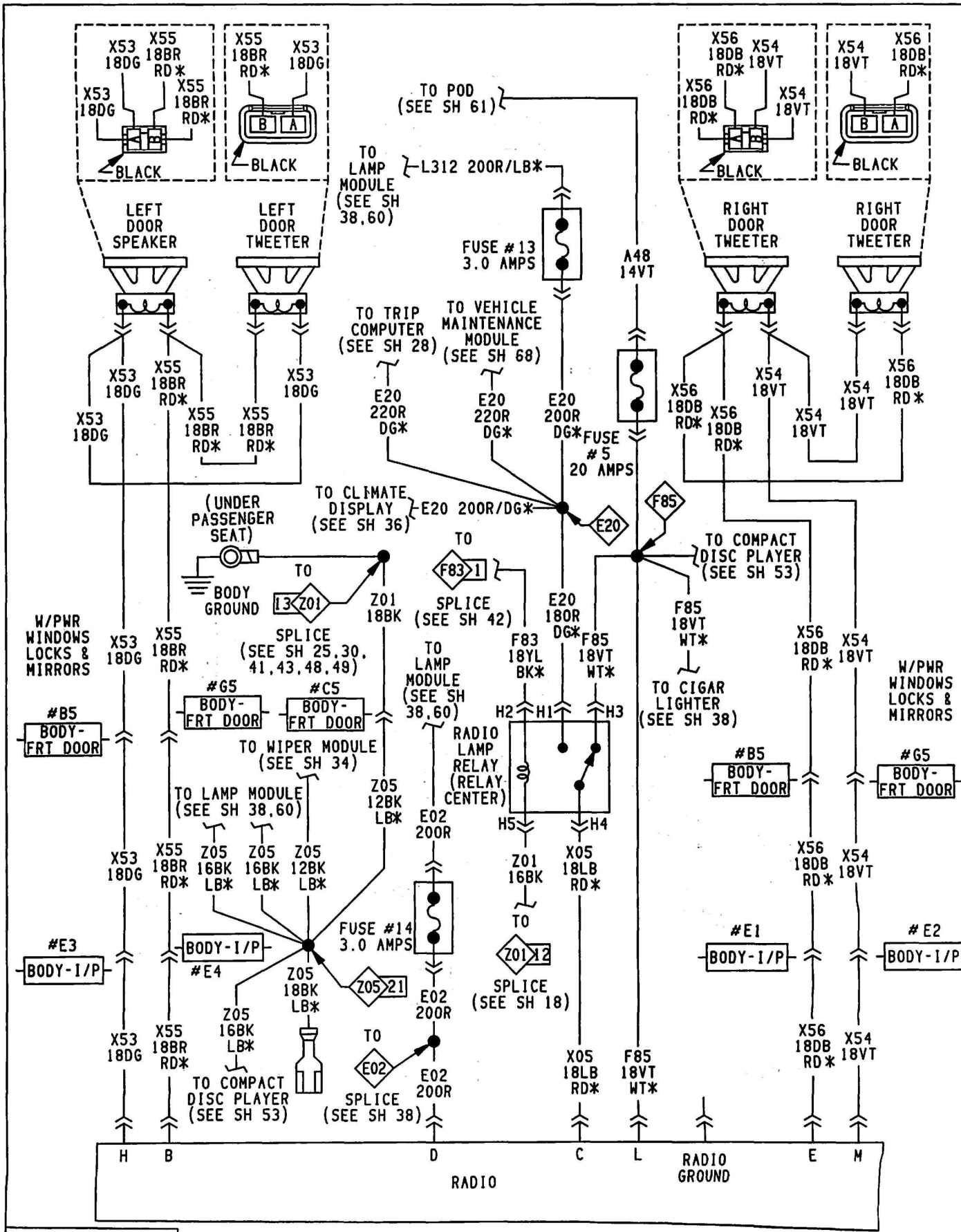


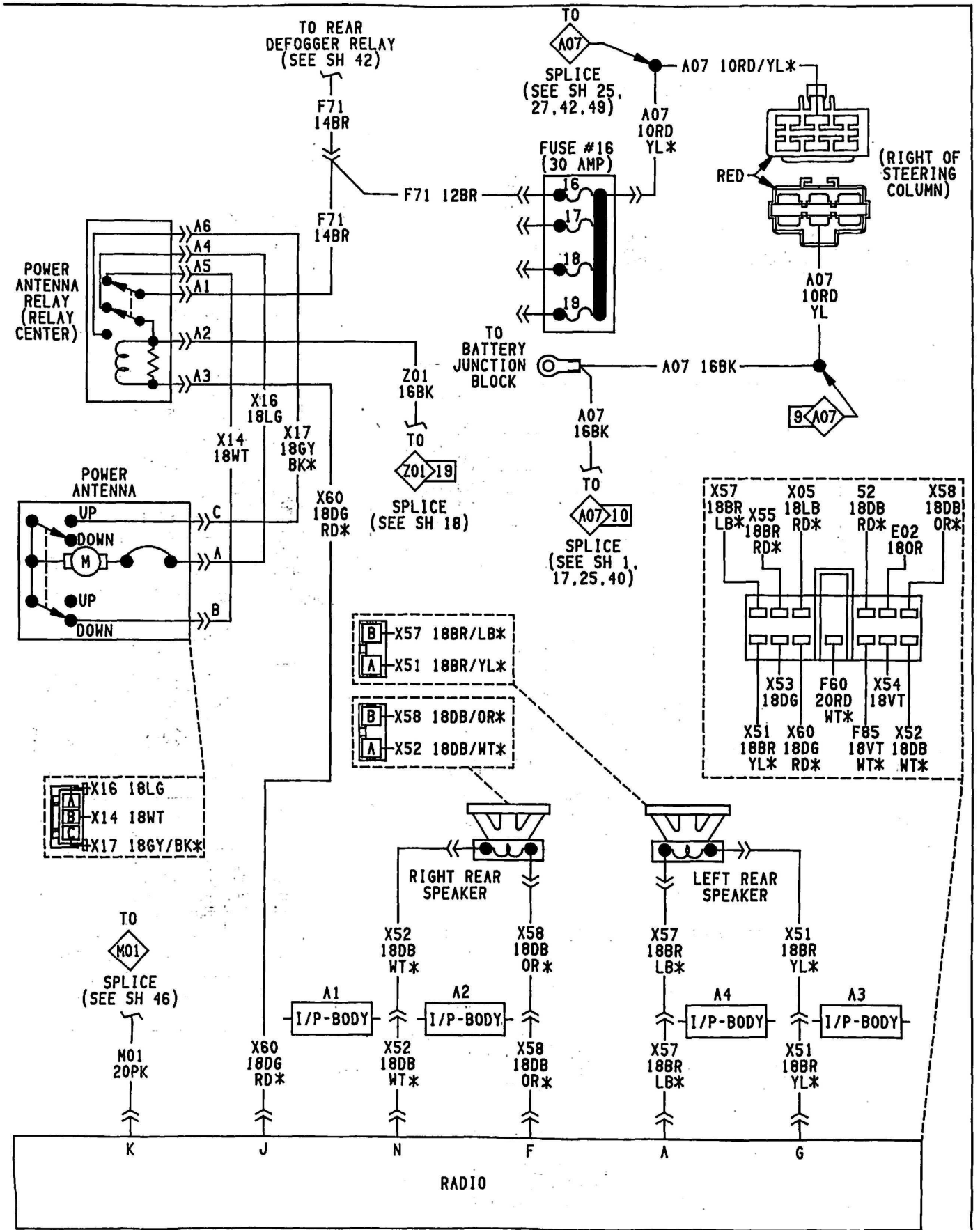
BB 49 POWER SEAT SYSTEM 908W-9

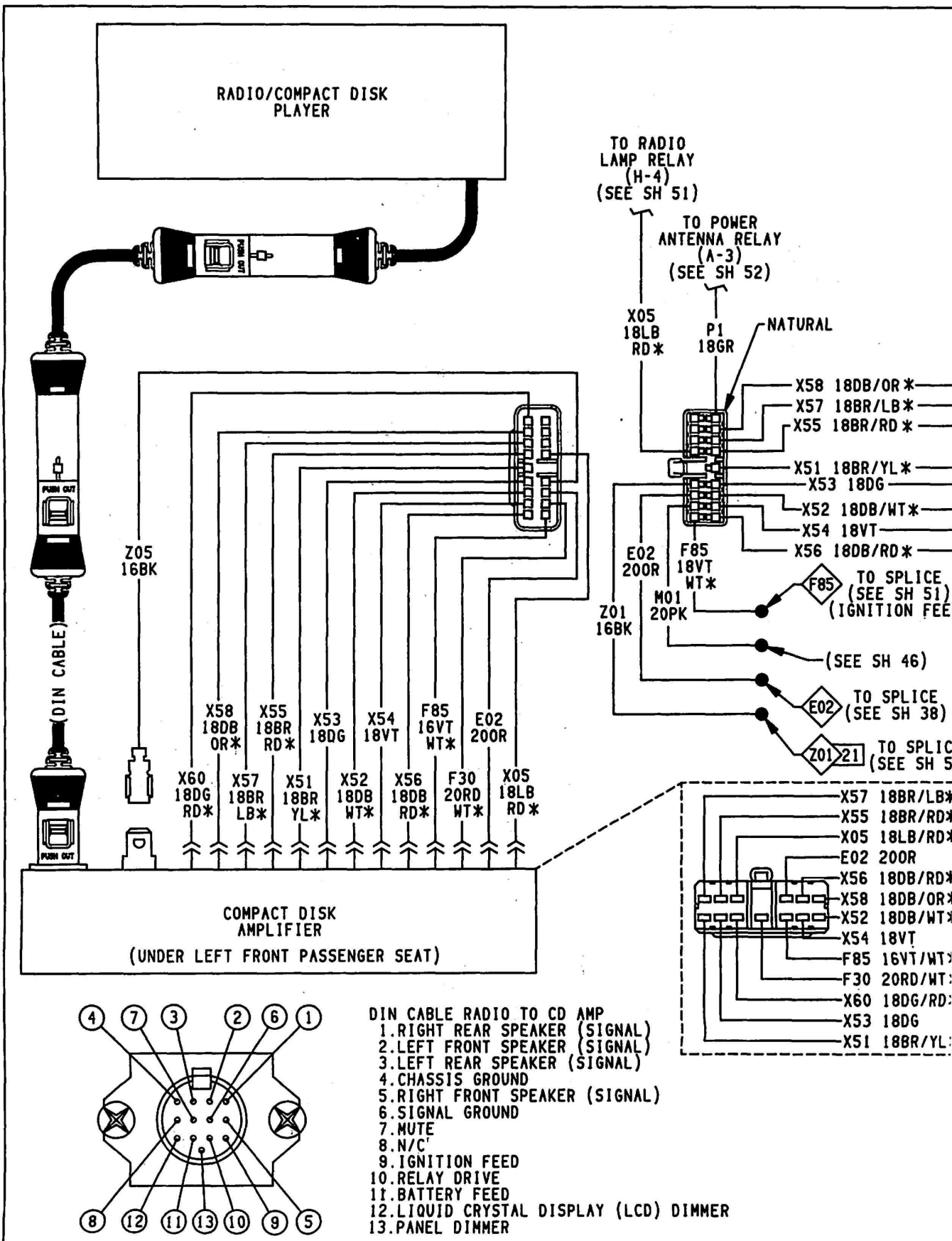


POWER SUNROOF SYSTEM

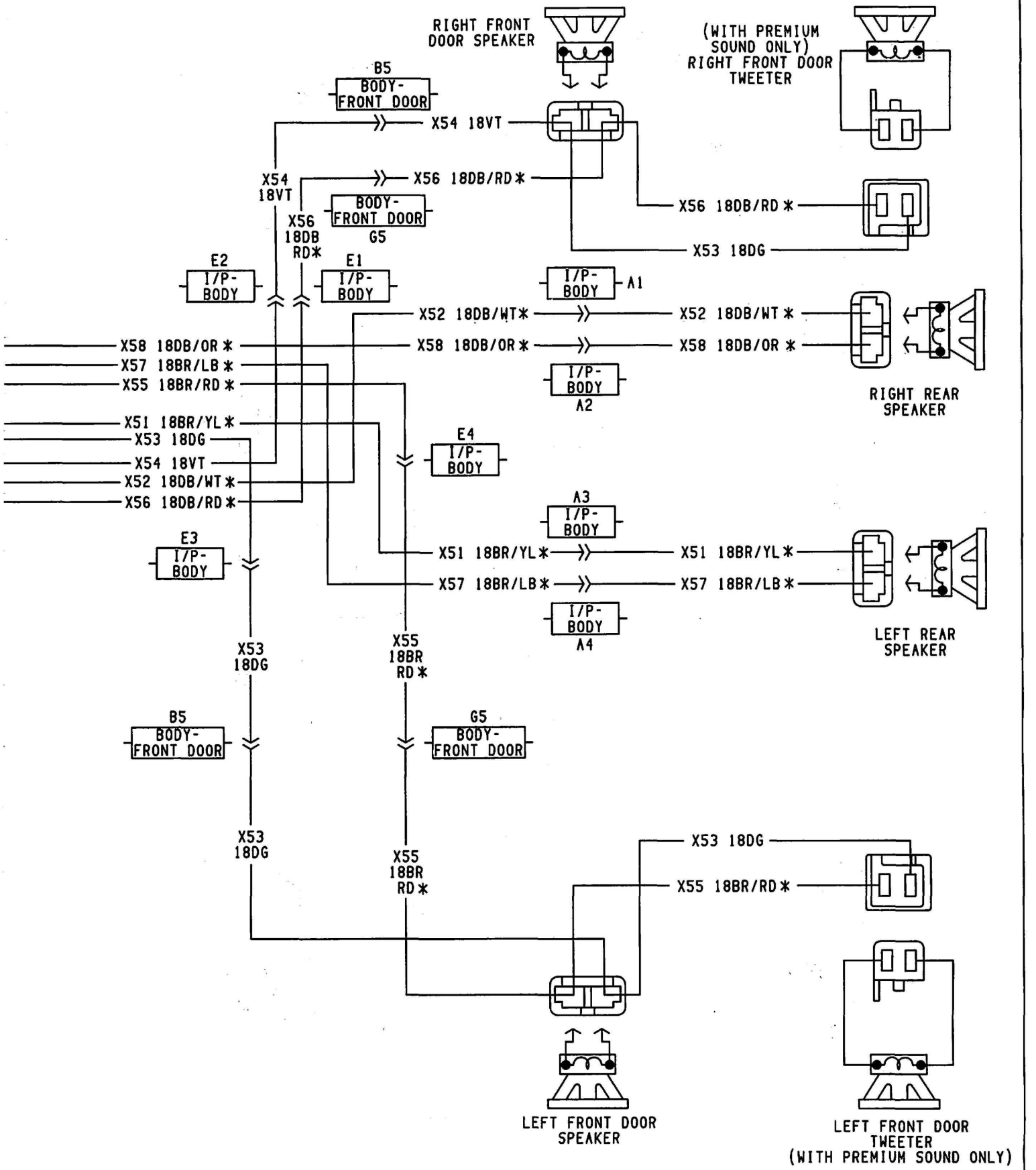
BB 50

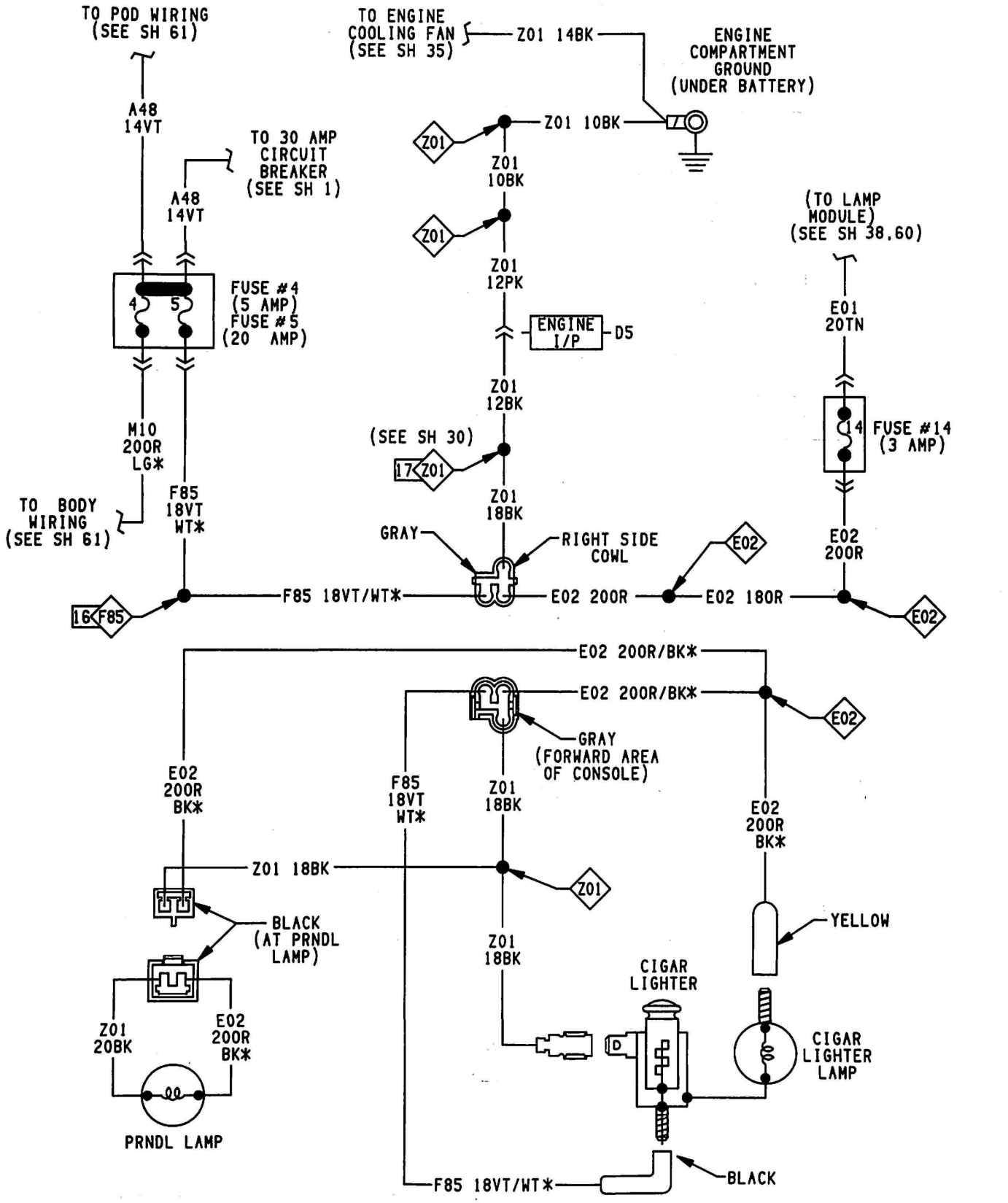

X53 18DG
X55 18BR RD*
BLACK
LEFT DOOR SPEAKER
LEFT DOOR TWEETER
RIGHT DOOR TWEETER
X56 18DB RD*
X54 18VT
TO POD (SEE SH 61)
TO LAMP MODULE (SEE SH 38,60)
L312 200R/LB*
FUSE #13 3.0 AMPS
A48 14VT
TO TRIP COMPUTER (SEE SH 28)
TO VEHICLE MAINTENANCE MODULE (SEE SH 68)
E20 220R DG*
E20 200R DG*
FUSE #5 20 AMPS
TO CLIMATE DISPLAY (SEE SH 36)
E20 200R/DG*
E20
F85
(UNDER PASSENGER SEAT)
BODY GROUND
TO
Z01 18BK
SPLICE (SEE SH 25,30, 41,43,48,49)
F83 1
SPLICE (SEE SH 42)
TO COMPACT DISC PLAYER (SEE SH 53)
W/PWR WINDOWS LOCKS & MIRRORS
F83 18YL BK*
F85 18VT WT*
TO CIGAR LIGHTER (SEE SH 38)
#B5 BODY-FRT DOOR
#G5 BODY-FRT DOOR
#C5 BODY-FRT DOOR
TO WIPER MODULE (SEE SH 34)
TO LAMP MODULE (SEE SH 38,60)
Z05 12BK LB*
RADIO LAMP RELAY (RELAY CENTER)
H1
H2
H3
H4
H5
E02 200R
Z01 16BK
X05 18LB RD*
FUSE #14 3.0 AMPS
#E3 BODY-I/P
#E4 BODY-I/P
#E1 BODY-I/P
#E2 BODY-I/P
Z05 16BK LB*
Z05 18BK LB*
Z05 21
Z01 12
SPLICE (SEE SH 18)
TO COMPACT DISC PLAYER (SEE SH 53)
TO E02
SPLICE (SEE SH 38)
H
B
D
C
L
RADIO GROUND
E
M
RADIO


TO REAR DEFOGGER RELAY (SEE SH 42)
F71 14BR
F71 12BR
F71 14BR
TO A07
SPLICE (SEE SH 25, 27, 42, 49)
A07 10RD/YL*
A07 10RD YL*
FUSE #16 (30 AMP)
16
17
18
19
RED
(RIGHT OF STEERING COLUMN)
A07 10RD YL
POWER ANTENNA RELAY (RELAY CENTER)
A6
A4
A5
A1
A2
A3
TO BATTERY JUNCTION BLOCK
A07 16BK
A07 16BK
Z01 16BK
TO Z01 19
SPLICE (SEE SH 18)
TO A07 10
SPLICE (SEE SH 1, 17, 25, 40)
9 A07
X16 18LG
X14 18WT
X17 18GY BK*
X60 18DG RD*
POWER ANTENNA
UP
DOWN
M
C
A
B
UP
DOWN
X57 18BR LB*
X55 18BR RD*
X05 18LB RD*
52 18DB RD*
E02 180R
X58 18DB OR*
X53 18DG
F60 20RD WT*
X54 18VT
X51 18BR YL*
X60 18DG RD*
F85 18VT WT*
X52 18DB WT*
B X57 18BR/LB*
A X51 18BR/YL*
B X58 18DB/OR*
A X52 18DB/WT*
A X16 18LG
B X14 18WT
C X17 18GY/BK*
RIGHT REAR SPEAKER
LEFT REAR SPEAKER
TO M01
SPLICE (SEE SH 46)
M01 20PK
X52 18DB WT*
X58 18DB OR*
X57 18BR LB*
X51 18BR YL*
A1
A2
A4
A3
I/P-BODY
I/P-BODY
I/P-BODY
I/P-BODY
X52 18DB WT*
X58 18DB OR*
X57 18BR LB*
X51 18BR YL*
X60 18DG RD*
K
J
N
F
A
G
RADIO



BB 53 COMPACT DISK

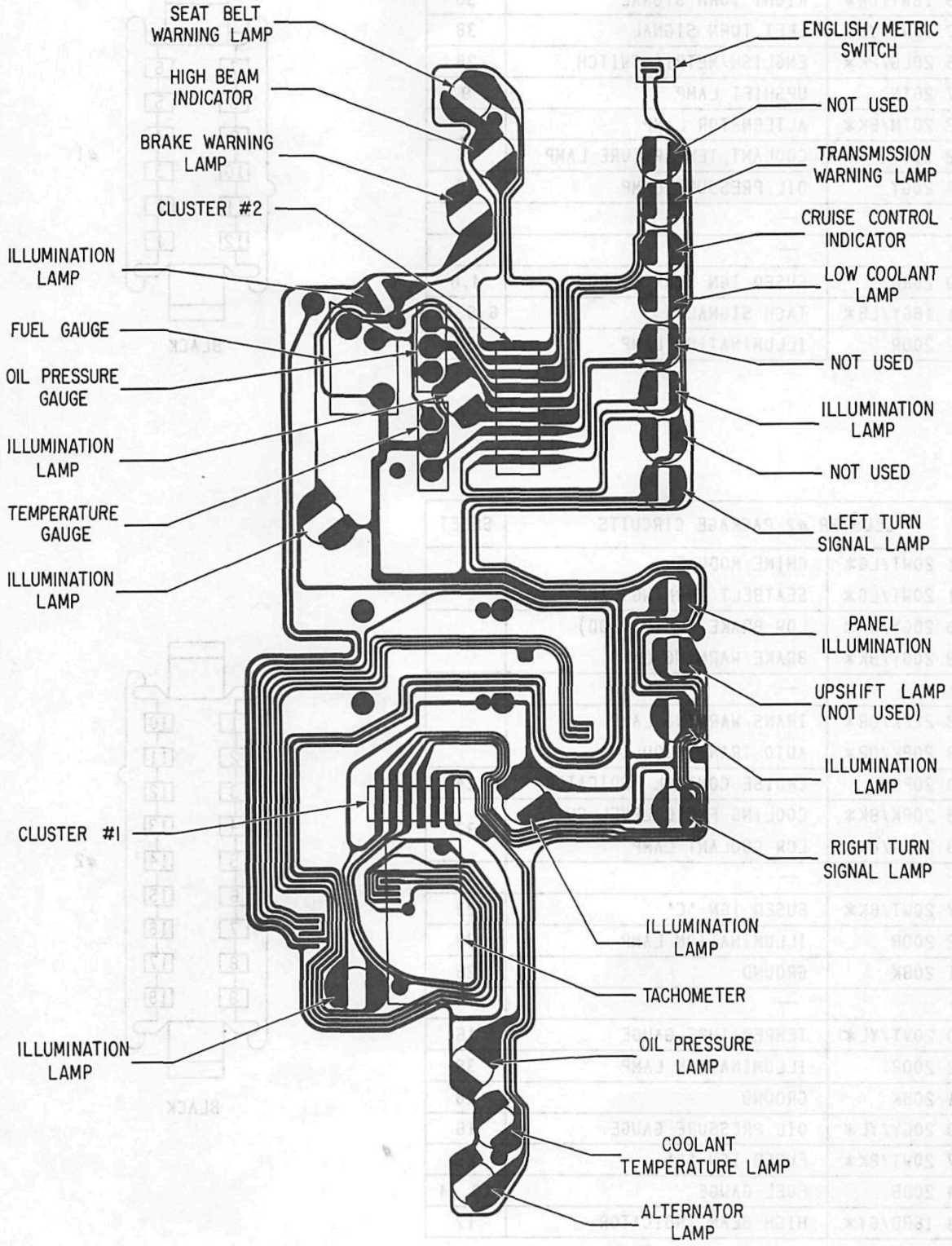

RIGHT FRONT DOOR SPEAKER
(WITH PREMIUM SOUND ONLY) RIGHT FRONT DOOR TWEETER
B5 BODY-FRONT DOOR
X54 18VT
X56 18DB/RD*
X54 18VT
X56 18DB RD*
BODY-FRONT DOOR G5
X56 18DB/RD*
X53 18DG
E2 I/P-BODY
E1 I/P-BODY
I/P-BODY A1
X52 18DB/WT*
X52 18DB/WT*
X58 18DB/OR*
X58 18DB/OR*
X58 18DB/OR*
X57 18BR/LB*
X55 18BR/RD*
I/P-BODY A2
RIGHT REAR SPEAKER
X51 18BR/YL*
X53 18DG
X54 18VT
X52 18DB/WT*
X56 18DB/RD*
E4 I/P-BODY
A3 I/P-BODY
X51 18BR/YL*
X51 18BR/YL*
E3 I/P-BODY
X57 18BR/LB*
X57 18BR/LB*
I/P-BODY A4
LEFT REAR SPEAKER
X53 18DG
X55 18BR RD*
B5 BODY-FRONT DOOR
G5 BODY-FRONT DOOR
X53 18DG
X55 18BR RD*
X53 18DG
X55 18BR/RD*
LEFT FRONT DOOR SPEAKER
LEFT FRONT DOOR TWEETER (WITH PREMIUM SOUND ONLY)



BB 55

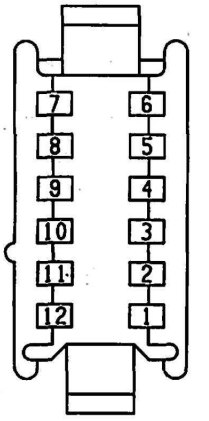
FLOOR CONSOLE

908W-9



PRINTED CIRCUIT BOARD

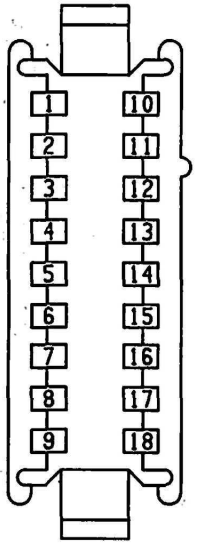
CAV	CLUSTER #1 PACKAGE CIRCUITS		SHEET
1	L66 16WT/OR*	RIGHT TURN SIGNAL	38
2	L67 16WT/YL*	LEFT TURN SIGNAL	38
3	G25 20LG/PK*	ENGLISH/METRIC SWITCH	28
4	G17 20TN	UPSHIFT LAMP	9
5	G12 20TN/BK*	ALTERNATOR LAMP	4
6	G02 20VT	COOLANT TEMPERATURE LAMP	16
7	G06 20GY	OIL PRESSURE LAMP	16
8	—	—	
9	—	—	
10	F80 20RD	FUSED IGN START & RUN	4,6
11	G21 18GY/LB*	TACH SIGNAL	6,9,13
12	E02 200R	ILLUMINATION LAMP	38



#1

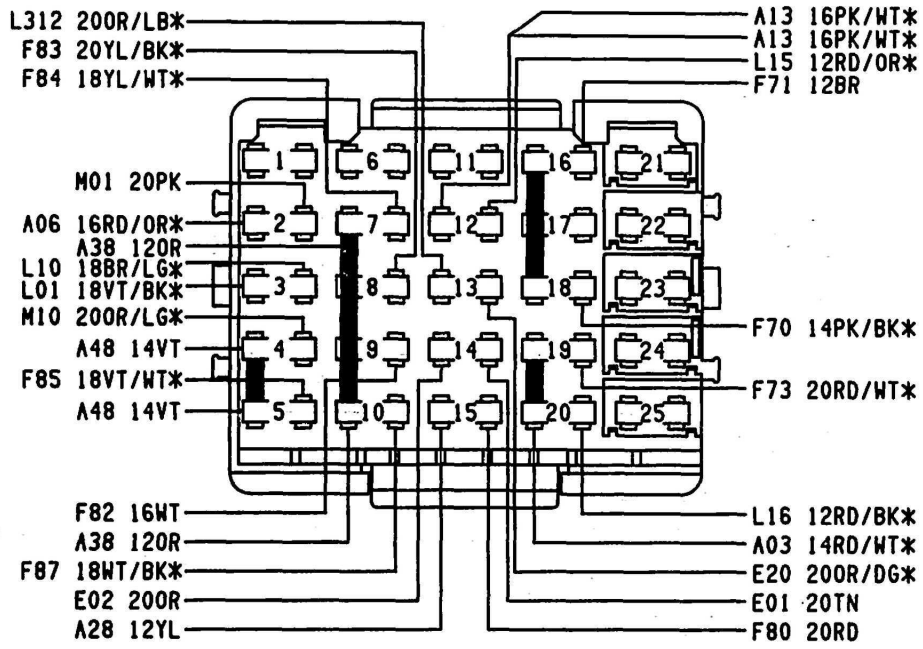
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CAV	CLUSTER #2 PACKAGE CIRCUITS		SHEET
1	G11 20WT/LG* G11 20WT/LG*	CHIME MODULE SEATBELT WARNING LAMP	26,31
2	G09 20GY/BK* G09 20GY/BK*	LOW BRAKE FLUID (POD) BRAKE WARNING LAMP	37
3	—	—	
4	G68 22PK/OR* G68 20PK/OR*	TRANS WARNING LAMP AUTO TRANS MODULE	10,14
5	V60 20PK	CRUISE CONTROL INDICATOR	24
6	G18 20PK/BK* G18 22PK/BK*	COOLING FLUID LEVEL SW LOW COOLANT LAMP	37
7	—	—	
8	F87 20WT/BK*	FUSED IGN "C"	23
9	E02 200R	ILLUMINATION LAMP	38
10	Z01 20BK	GROUND	28
11	—	—	
12	G20 20VT/YL*	TEMPERATURE GAUGE	16
13	E02 200R	ILLUMINATION LAMP	38
14	Z01 20BK	GROUND	28
15	6G0 20GY/YL*	OIL PRESSURE GAUGE	16
16	F87 20WT/BK*	FUSED IGN "C"	23
17	G04 20DB	FUEL GAUGE	10,14
18	G34 16RD/GY*	HIGH BEAM INDICATOR	17



#2

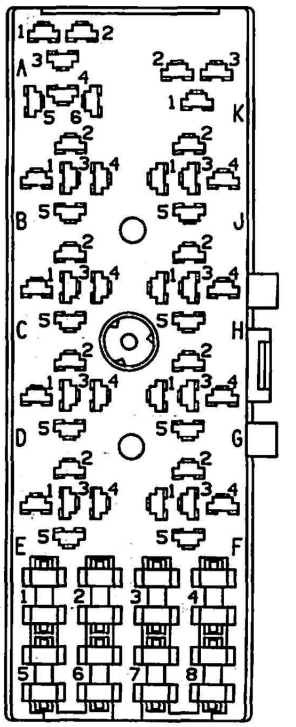
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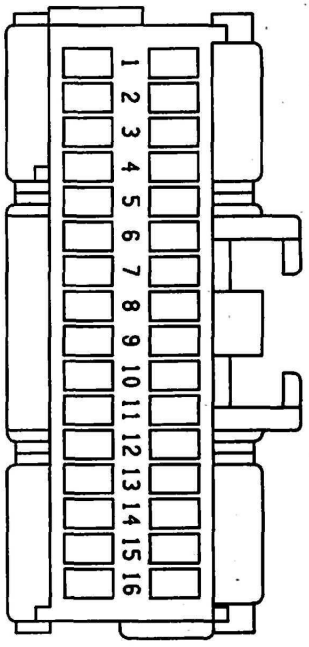
FRONT OF FUSEBLOCK

FUSE#	AMPS	COLOR	SHEET
1	—	—	—
2	15	RED	1,28,46,38,46
3	5	TAN	2,39
4	5	TAN	1,30,55
5	20	YELLOW	1,51,55
6	—	—	—
7	7.5	TAN	1,23
8	15	NATURAL	1,31,36,42
9	15	NATURAL	1,38
10	10	RED	1,23,35
11	—	—	—
12	20	YELLOW	2,17,39
13	3	TAN	1,38,51
14	3	TAN	1,38,51,55
15	10	RED	2,4,6
16	30	LIGHT GREEN	2,42,52
17	15	NATURAL(NOT USED)	2
18	20	YELLOW	2,27
19	10	RED	2,25
20	20	YELLOW	2,17,22,39
21	22	CIRCUIT BREAKER	2,17,22,39
22	30	CIRCUIT BREAKER (POWER SEATS/DOOR LOCKS) OPTION	2,48
23	30	CIRCUIT BREAKER (PASSIVE RESTRAINT) OPTION	2,25
24	30	CIRCUIT BREAKER	1,34
25	30	CIRCUIT BREAKER (POWER WINDOW/SUNROOF) OPTION	2,43,50

CAV	RELAY CIRCUITS		SHEET
A1	F71 14BR	HEATED BACKLITE	52
A2	Z01 16BK	GROUND	52
A3	X60 18DG/RD*	POWER ANTENNA FEED	52
A4	X16 18LG	POWER ANTENNA	52
A5	X14 18WT	POWER ANTENNA	52
A6	X17 18GY/BK*	POWER ANTENNA	52
B1	F71 12BR F71 14BR	FUSED BATTERY '25' HEATED BACKLITE	42
B2	C80 18DB/WT*	HEATED BACKLITE COIL	42
B3	—	—	—
B4	C15 12BK/WT*	REAR DEFROSTER	42
B5	F83 18YL/BK*	FUSED IGN 'B'	42
C1	F34 14TN/BK* F34 14TN/BK*	LOW BEAM RELAY LOW BEAM RELAY	17
C2	L94 20LG/RD*	LOW BEAM RELAY	17
C3	—	—	
C4	L04 16VT/WT*	LOW BEAM	17
C5	F34 14TN/BK* F34 14TN/BK*	HEADLAMP SWITCH TO FUSE HEADLAMP SWITCH TO FUSE	17
D1	F34 14TN/BK* F34 14TN/BK*	HEADLAMP SWITCH TO FUSE HEADLAMP SWITCH TO FUSE	17
D2	L93 18PK	LOW BEAM RELAY	17
D3	—	—	—
D4	L03 16RD/OR*	HIGH BEAM	17
D5	F34 14TN/BK* F34 14TN/BK*	HEADLAMP SWITCH TO FUSE LOW BEAM RELAY	17
E1	—	—	—
E2	—	—	—
E3	—	—	—
E4	—	—	—
E5	—	—	—
F1	—	—	—
F2	—	—	—
F3	—	—	—
F4	—	—	—
F5	—	—	—
G1	F70 14PK/BK* F70 14PK/BK*	BRAKE SWITCH HORN RELAY	27
G2	F70 14PK/BK* F70 14PK/BK*	FUSED BATTERY 'B' HORN RELAY	27
G3	—	—	—
G4	X02 14DG/RD*	RIGHT HORN	27
G5	X04 18GY/OR*	HORN	27
H1	E20 18OR/DG*	RADIO LAMP RELAY	51
H2	F83 18YL/BK*	FUSED IGN 'B'	51
H3	F85 18VT/WT*	ACCESSORY	51
H4	X05 18LB/RD*	LCD BACKLITE	51
H5	Z01 16BK	GROUND	51
J1	Z01 16BK	GROUND	18,39
J2	L79 20TN L79 20TN	POWER ANTENNA UP PARK LAMPS	18,39
J3	—	—	—
J4	L90 18DB/RD*	PARK,TAIL,SIDEMARKER LPS	18,39
J5	Z01 16BK	GROUND	18,39
K1	—	—	—
K2	—	—	—
K3	—	—	—



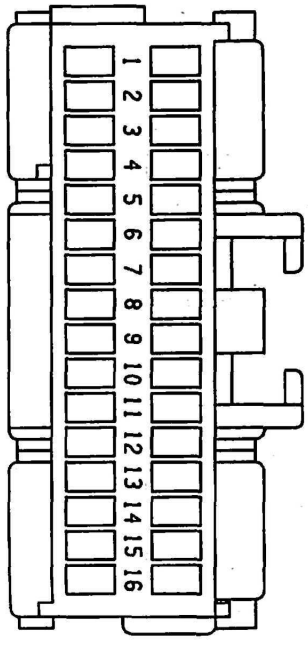
LAMP MODULE



BLACK

CAV	LAMP MODULE CIRCUITS		SHEET
C1	L11 20LG/BK*	HI BEAM FLASH	37
C2	L324 20WT/LG*	HEADLAMP DIMMER	37
C3	L301 20LB/OR*	RIGHT TURN CANCEL	37
C4	L302 20LB/YL*	RIGHT TURN SIGNAL	37
C5	L303 20BR/LG*	RIGHT TURN SIGNAL	37
C6	L311 20LG/YL*	HEADLAMP OFF	37
C7	L308 20LG/RD*	PARK LAMP SELECT	37
C8	L307 20LG/OR*	HEADLAMP SELECT	37
C9	E90 20PK/OR*	DIMMER SWITCH FEED	37
C10	Z05 16BK/LB*	GROUND	38,51
C11	Z05 16BK/LB*	GROUND	38,51
C12	L61 16GY	LEFT TURN LAMP	20,37
C13	L60 16BR	RIGHT TURN LAMP	20,37
C14	L73 16PK/WT*	LEFT TURN SIGNAL	20,38
C15	L74 16PK/BK*	RIGHT TURN SIGNAL	38,39
C16	L67 16WT/YL*	LEFT TURN SIGNAL	38
D1	L12 20VT/TN*	HAZARD FLASHER	38
D2	L300 20YL/WT*	LEFT TURN CANCEL	37
D3	L305 20LB/WT*	LEFT TURN SIGNAL	37
D4	L304 20BR/OR*	LEFT TURN SIGNAL	37
D5	E89 20GY	PANEL LAMP/WIPER	37
D6	F82 16WT	FUSED IGN "A"	38
D7	E01 20TN	I/P ILLUMINATION	38,51
D8	L312 20OR/LB*	LCD BACKLIGHTING	38,51
D9	L50 18WT/TN*	STOPLAMP FEED	24,32,38
D10	E91 20LB/LG*	I/P LAMP	37
D11	L66 16WT/OR*	RIGHT TURN SIGNAL	38
D12	G81 20DB/RD*	TONE LINE	31,38
D13	L79 20TN	PARK LAMPS	18,31,38,40
D14	L93 18PK	HIGH BEAM RELAY	17,38
D15	L94 20LG/RD*	LOW BEAM RELAY	17,38
D16	A13 16PK/WT*	FEED FROM HEADLAMP CPU	31,38,41,48

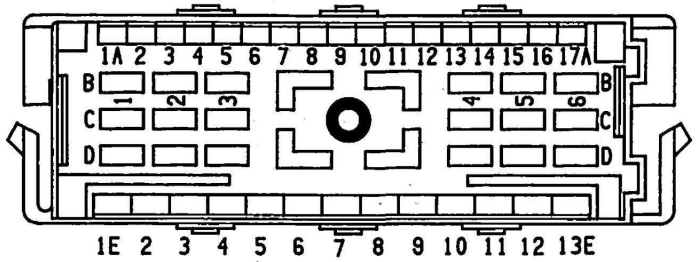
HEVAC MODULE



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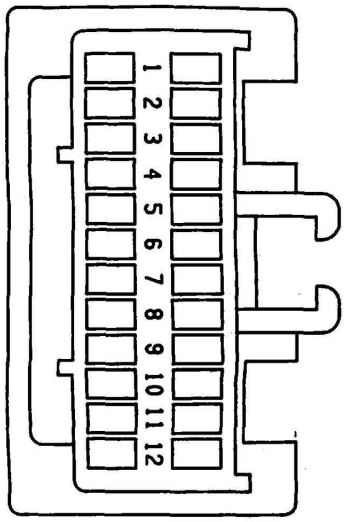
CAV	HEVAC MODULE CIRCUITS		SHEET
C1	C84 20OR/LG*	VENT SELECT	36
C2	C85 20OR/WT*	FRONT DEFOGGER	36
C3	—	NOT USED	—
C4	—	NOT USED	—
C5	C82 20YL/OR*	TEMP SELECT	36
C6	K61 20YL/BK*	ECU A/C OUT	7,11
C7	—	NOT USED	—
C8	C21 20DB/OR*	A/C LOW PRESSURE SWITCH	36
C9	—	NOT USED	—
C10	G25 20LG/PK*	ENGLISH/METRIC	28,36
C11	C89 20GY/YL*	REAR DEFOGGER	36,42
C12	C10 20RD/TN*	TEMP SENSOR (IN CAR)	36
C13	C08 20DG/RD*	AMBIENT TEMP SENSOR	36
C14	D41 20LG/WT*	DATA STREAM	36
C15	D40 20GY/BK*	CLOCK SIGNAL	36
C16	C91 20LB	A/C REQUEST	10,14,36
D1	C13 20DB/YL*	A/C CLUTCH RELAY	36
D2	C80 18DB/WT*	REAR DEFOGGER RELAY	31
D3	F87 20WT/BK*	FUSED IGN "C"	23,24
D4	—	NOT USED	—
D5	Z07 20BK/RD*	SENSOR GROUND	36
D6	C86 20YL/LG*	DEFOGGER	36,42
D7	Z01 20BK	GROUND	30,31,51
D8	—	NOT USED	—
D9	L79 20TN	PARK LAMP RELAY	18,31,39
D10	C81 20LB/WT*	REAR DEFOGGER	42
D11	Z04 20PK	GROUND REFERENCE	36
D12	C88 20TN/BK*	ON SELECT	36
D13	F73 20RD/WT*	FUSED BATTERY "A"	31,42,46
D14	C87 20LB/RD*	OFF SELECT	36
D15	C83 20VT/OR*	FAN SELECT	36
D16	C90 20LG	A/C SELECT	10,14,36

POD
CONNECTOR



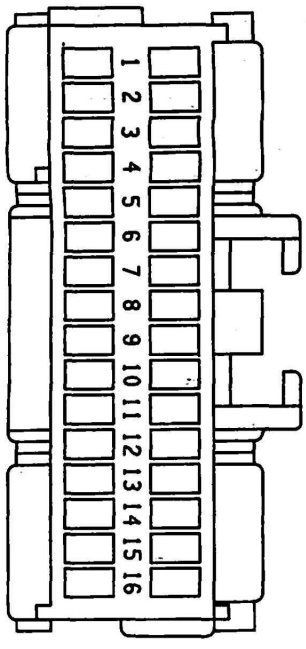
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CAV	INSTRUMENT PANEL CIRCUITS		SHEET
A1	L302 20LB/YL*	RIGHT TURN SIGNAL	37
A2	L303 20BR/LG*	RIGHT TURN SIGNAL	37
A3	L304 20BR/OR*	LEFT TURN SIGNAL	37
A4	L305 20LB/WT*	LEFT TURN SIGNAL	37
A5	L324 20WT/LG*	HEADLAMP DIMMER	37
A6	L11 20LG/BK*	HI BEAM FLASH	37
A7	L307 20LG/OR*	HEADLAMP SELECT	37
A8	L308 20LG/RD*	PARK LAMP SELECT	37
A9	L311 20LG/YL*	HEADLAMP OFF	37
A10	E91 20LB/LG*	I/P LAMP	37
A11	E90 20PK/OR*	DIMMER SWITCH FEED	37
A12	E89 20GY	PANEL LAMP WIPER	37
A13	E02 20OR	I/P ILLUMINATION	38
A14	Z02 20BK/LG*	GROUND	10,14
A15	—	NOT USED	—
A16	M02 20YL	SWITCHED GROUND	30
A17	Z01 20BK	GROUND	28
B1	Z01 20BK	GROUND	15,28
B2	G16 20BK/LB*	SWITCHED GROUND	26,30
B3	X04 18GY/OR*	HORN RELAY	27
B4	Z02 20BK/LG*	GROUND	10,14
B5	A28 12YL A28 12YL	IGNITION I-START & RUN	4,6,15
B6	A09 12RD	UNFUSED BATTERY	15
C1	G09 20GY/BK*	LOW BRAKE FLUID	15
C2	G26 20LB	KEY IGNITION WARNING	31
C3	Z01 18BK	GROUND	28
C4	L300 20YL/WT*	LEFT TURN CANCEL	37
C5	A38 12OR	IGNITION 3-RUN	15,31,35, 36,38,42
C6	—	NOT USED	—
D1	A41 14YL	SIGNAL TO STARTER	6,15
D2	A48 14VT A48 14VT	RUN & ACCY	15,30,34, 43,50,51,55
D3	V37 20RD/LG*	SPEED SET	24
D4	L301 20LB/OR*	RIGHT TURN CANCEL	37
D5	A09 12RD A09 12RD	UNFUSED BATTERY	15
D6	—	NOT USED	—
E1	Z01 20BK	GROUND	28
E2	E02 20OR	I/P ILLUMINATION	38
E3	C86 20YL/LG*	HEVAC MODULE TO GROUND	36
E4	C81 20LB/WT*	REAR DEFOGGER	42
E5	C82 20YL/OR*	TEMP SELECT	36
E6	C83 20VT/OR*	FAN SELECT	36
E7	C84 20OR/LG*	VENT SELECT	36
E8	C85 20OR/WT*	FRONT DEFOGGER	36
E9	C87 20LB/RD*	SELECT OFF	36
E10	C88 20TN/BK*	SELECT ON	36
E11	Z07 20BK/RD*	HAZARD FLASH GROUND	36
E12	C89 20GY/YL*	AMBIENT TEMPERATURE	36,42
E13	—	NOT USED	—



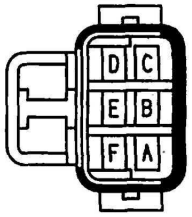
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CAV	E.C.U. CIRCUITS		SHEET
A1	-	NOT USED	
A2	-	NOT USED	
A3	-	NOT USED	
A4	-	NOT USED	
A5	K 18OR/LG*	FUEL PUMP RELAY	8,12
A6	-	NOT USED	
A7	-	NOT USED	
A8	G17 20BR	UPSHIFT LAMP (4 CYL ONLY)	9
A9	K80 18BK/LG*	B+ RELAY COIL	7,11
A10	K35 18GY/YL*	EGR SOLENOID	8,12
A11	-	NOT USED	
A12	K61 20YL/BK*	ECU A/C OUTPUT	7,11
B1	K11 16LB	INJECTOR (4 CYL ONLY)	9
	K15 16PK/BK*	INJECTOR 6 CYL ONLY)	12
B2	K16 16LG/BK*	INJECTOR (6 CYL ONLY)	12
B3	K76 18BR	IDLE ACTUATOR (REV) 4 CYL ONLY	7
	K97 16BR	ISC VALVE (6 CYL)	11
B4	K77 18LG	IDLE ACTUATOR (FWD) 4 CYL ONLY	7
	K98 16LB/RD*	DIAGNOSTIC # 2 (6 CYL)	11
B5	-	NOT USED	
B6	-	NOT USED	
B7	A05 16RD	UNFUSED BATTERY	8,12
B8	A62 16VT/WT*	CLEAN POWER	8,13
B9	T61 20LG/RD*	EEC TO AUTO TRANS	9,13
B10	K81 16PK	B+ RELAY OUTPUT	4,7,11
B11	Z01 16BK	GROUND	8,12
B12	Z01 16BK	GROUND	8,12



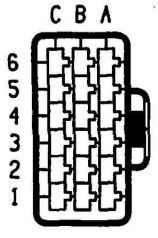
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CAV	E.C.U. CIRCUITS		SHEET
C1	K25 20WT/BK*	SPEED SENSOR	9,13
C2	C91 20LB	A/C RELAY	10,14,36
C3	T40 16BR	STARTER SOLENOID	6,9,13
C4	T41 18BK/WT*	NEUTRAL SAFETY	6,10,14
C5	-	NOT USED	
C6	K 18VT	MAP SENSOR	7,11
C7	K22 18OR/DB*	THROTTLE POSITION SENSOR	7,11
C8	K21 18BK/RD*	AIR TEMP SENSOR	8,12
C9	-	NOT USED	
C10	K02 18TN/BK*	COOLANT TEMP SENSOR	7,9,11
C11	A61 16DG/BK*	FUEL PUMP RELAY	8,12
C12	D83 18BK/PK*	DIAGNOSTIC 1	7,11
C13	-	NOT USED	
C14	K70 18VT/RD*	MAP SENSOR	7,11
C15	K06 18VT/WT*	TPS SENSOR FEED	7,11
C16	-	NOT USED	
D1	K27 20RD/LG*	SPEED SENSOR	9,13
D2	C90 20LG	A/C SELECT	10,14,36
D3	K04 18BK/LB*	SENSOR GROUND	7,11
D4	-	NOT USED	
D5	K78 18GY	IDLE ACTUATOR	7
D6	D99 20BK/RD*	GROUND	7,11
D7	-	NOT USED	
D8	K31 18YL/BK	KNOCK SENSOR GROUND	9,13
D9	K41 18BK/DG	OXYGEN SENSOR (4 CYL ONLY)	9,13
D10	A61 16DG/BK*	FUEL PUMP RELAY (OUTPUT)	8,12
D11	D84 18BK/WT*	DIAGNOSTIC 2	7,11
D12	G08 22LB/BK*	FUEL FLOW	10,14,28
D13	K71 18YL	IGNITION	6,7,11
D14	-	NOT USED	
D15	G07 20WT/OR*	SPEED SIGNAL	10,14
D16	K30 18YL/LG*	KNOCK SENSOR	9,13



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CAV	AUTO TRANS CIRCUITS (ZF)		SHEET
A	F83 18YL/DG*	FUSED IGNITION 'B'	40
B	L01 18VT/BK*	BACKUP LAMPS	2,40
C	—	NOT USED	—
D	—	NOT USED	—
E	Z01 18BK	GROUND	12
F	T41 18BK/WT*	NEUTRAL SAFETY	6,14,24

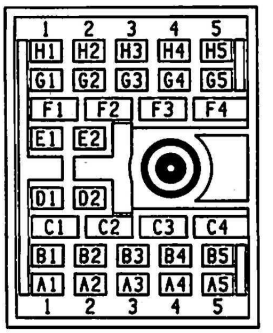


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CAV	AUTO TRANS CIRCUITS (AR 4)		SHEET
A1	—	NOT USED	—
A2	T61 20LG/RD*	AUTO TRANS	9,13
A3	L50 20WT/TN*	STOPLAMP SWITCH	24,32,37
A4	—	NOT USED	—
A5	—	NOT USED	—
A6	—	NOT USED	—
B1	L01 18VT/BK*	I/P TO AUTO TRANS	2,40
B2	—	NOT USED	—
B3	—	NOT USED	—
B4	—	NOT USED	—
B5	—	NOT USED	—
B6	T62 20YL/RD*	TRANS DIAGNOSTIC	9,13
C1	A28 18YL	IGNITION (START & RUN)	4,6
C2	F84 18YL/WT*	FUSED/SW B+ TO TRANS	1,23
C3	T41 18BK/WT*	NEUTRAL SAFETY	5,23
C4	—	NOT USED	—
C5	—	NOT USED	—
C6	G68 20PK/OR*	AUTO TRANS WARNING	10,14

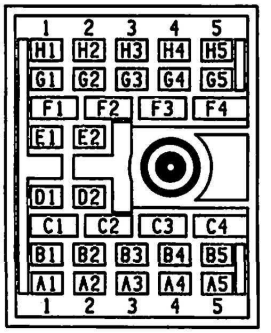
CAV	FRONT CROSSBODY CIRCUITS		SHEET
A1	—	NOT USED	—
A2	—	NOT USED	—
A3	—	NOT USED	—
A4	—	NOT USED	—
A5	—	NOT USED	—
B1	Q16 14BR/WT*	SWITCH TO MOTOR RF UP	43
B2	Q26 14VT/WT*	SWITCH TO MOTOR RF DOWN	43
B3	P79 20DB/LB*	LEFT MIRROR RET (-)	41
B4	P35 20OR/VT*	KEYLESS MOD LOCK	45,47
B5	X54 18VT	RIGHT FRONT SPEAKER FEED	51
C1	—	NOT USED	—
C2	M1 18PK	FUSED BATTERY 'A'	45,47
C3	P33 14OR/BK*	MOTOR LOCK RELAY	47
D1	—	NOT USED	—
D2	P78 20YL/LG*	RIGHT UP/DOWN MOTOR	41
E1	—	NOT USED	—
E2	P77 20WT/BK*	RIGHT/LEFT MOTOR	41
F1	—	NOT USED	—
F2	Z01 20BK	GROUND	47
F3	P34 14PK/BK*	MOTOR UNLOCK RELAY	47
G1	—	NOT USED	—
G2	—	NOT USED	—
G3	G74 20TN/RD*	RIGHT FRONT DOOR AJAR LAMP	47
G4	P36 20PK/VT*	SWITCH TO RELAY UNLOCK	45,47
G5	X56 18DB/RD*	RIGHT FRONT SPKR RETURN	51
H1	—	NOT USED	—
H2	—	NOT USED	—
H3	—	NOT USED	—
H4	—	NOT USED	—
H5	—	NOT USED	—

RIGHT HAND DOOR



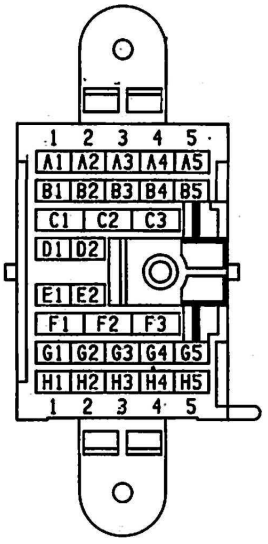
CAV	FRONT CROSSBODY CIRCUITS		SHEET
A1	—	NOT USED	—
A2	—	NOT USED	—
A3	—	NOT USED	—
A4	—	NOT USED	—
A5	—	NOT USED	—
B1	Q16 14BR/WT*	SWITCH TO MOTOR RF UP	43
B2	Q26 14VT/WT*	SWITCH TO MOTOR RF DOWN	43
B3	P79 20DB/LB*	LEFT MIRROR RET (-)	41
B4	P35 20OR/VT*	SWITCH TO RELAY LOCK	45,47
B5	X53 18DG	LEFT FRONT SPEAKER FEED	51
C1	F81 14TN	MASTER SWITCH FEED	43
C2	F60 20RD/WT*	FUSED BATTERY 'A'	45,47
C3	P02 14BK/WT*	MOTOR LOCK RELAY	47
D1	Q17 14DB/WT*	POWER WINDOW SWITCH	43
D2	P78 20YL/LG*	RIGHT POWER MIRROR	41
E1	Q27 14RD/BK*	POWER WINDOW SWITCH	43
E2	P77 20WT/BK*	RIGHT POWER MIRROR	41
F1	Q01 14YL	POWER WINDOW SWITCH	43
F2	Z01 20BK	GROUND	45,47
F3	P34 14PK/BK*	MOTOR UNLOCK RELAY	47
G1	Q18 14GY/BK*	SW TO MOTOR RIGHT RR UP	44
G2	Q28 14DG/WT*	SW TO MOTOR RIGHT RR DOWN	44
G3	G75 20TN	LEFT FRONT DOOR AJAR LAMP	47
G4	P36 20PK/VT*	SWITCH TO RELAY UNLOCK	45,47
G5	X55 18BR/RD*	LEFT FRONT SPKR RETURN	51
H1	—	NOT USED	—
H2	—	NOT USED	—
H3	—	NOT USED	—
H4	—	NOT USED	—
H5	—	NOT USED	—

LEFT HAND DOOR



FRONT CROSSBODY TO DOORS INTERCONNECT

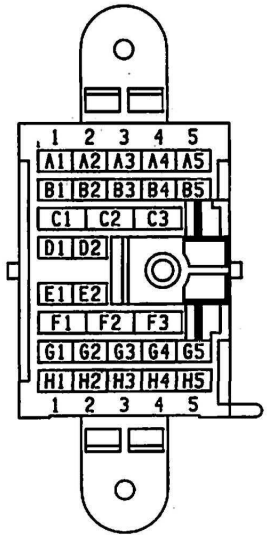
RIGHT HAND DOOR



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CAV	FRONT CROSSBODY CIRCUITS		SHEET
A1	—	NOT USED	—
A2	—	NOT USED	—
A3	—	NOT USED	—
A4	—	NOT USED	—
A5	—	NOT USED	—
B1	Q16 14BR/WT*	SWITCH TO MOTOR RF UP	43
B2	Q26 14VT/WT*	SWITCH TO MOTOR RF DOWN	43
B3	P79 20DB/LB*	LEFT MIRROR RET (-)	41
B4	P35 20OR/VT*	KEYLESS MOD LOCK	45,47
B5	X54 18VT	RIGHT FRONT SPEAKER FEED	51
C1	—	NOT USED	—
C2	F60 20RD/WT*	FUSED BATTERY 'A'	45,47
C3	P02 14BK/WT*	MOTOR LOCK RELAY	47
D1	—	NOT USED	—
D2	P78 20YL/LG*	RIGHT UP/DOWN MOTOR	41
E1	—	NOT USED	—
E2	P77 20WT/BK*	RIGHT/LEFT MOTOR	41
F1	Q01 14VT/WT*	POWER WINDOW FEED	43
F2	Z01 20BK	GROUND	47
F3	P34 14PK/BK*	MOTOR UNLOCK RELAY	47
G1	—	NOT USED	—
G2	—	NOT USED	—
G3	G74 20TN/RD*	RIGHT FRONT DOOR AJAR LAMP	47
G4	P36 20PK/VT*	SWITCH TO RELAY UNLOCK	45,47
G5	X56 18DB/RD*	RIGHT FRONT SPKR RETURN	51
H1	—	NOT USED	—
H2	—	NOT USED	—
H3	—	NOT USED	—
H4	—	NOT USED	—
H5	—	NOT USED	—

LEFT HAND DOOR



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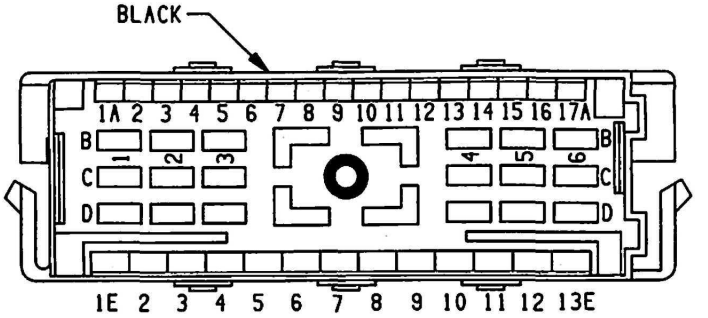
CAV	FRONT CROSSBODY CIRCUITS		SHEET
A1	—	NOT USED	—
A2	—	NOT USED	—
A3	—	NOT USED	—
A4	—	NOT USED	—
A5	—	NOT USED	—
B1	Q16 14BR/WT*	SWITCH TO MOTOR RF UP	43
B2	Q26 14VT/WT*	SWITCH TO MOTOR RF DOWN	43
B3	P79 20DB/LB*	LEFT MIRROR RET (-)	41
B4	P35 20OR/VT*	SWITCH TO RELAY LOCK	45,47
B5	X53 18DG	LEFT FRONT SPEAKER FEED	51
C1	F81 14TN	MASTER SWITCH FEED	43
C2	F60 20RD/WT*	FUSED BATTERY 'A'	45,47
C3	P02 14BK/WT*	MOTOR LOCK RELAY	47
D1	Q17 14DB/WT*	POWER WINDOW SWITCH	43
D2	P78 20YL/LG*	RIGHT POWER MIRROR	41
E1	Q27 14RD/BK*	POWER WINDOW SWITCH	43
E2	P77 20WT/BK*	RIGHT POWER MIRROR	41
F1	Q01 14YL	POWER WINDOW SWITCH	43
F2	Z01 20BK	GROUND	41,43,47
F3	P34 14PK/BK*	MOTOR UNLOCK RELAY	47
G1	Q18 14GY/BK*	SW TO MOTOR RIGHT RR UP	44
G2	Q28 14DG/WT*	SW TO MOTOR RIGHT RR DOWN	44
G3	G75 20TN	LEFT FRONT DOOR AJAR LAMP	47
G4	P36 20PK/VT*	SWITCH TO RELAY UNLOCK	45,47
G5	X55 18BR/RD*	LEFT FRONT SPKR RETURN	51
H1	—	NOT USED	—
H2	—	NOT USED	—
H3	—	NOT USED	—
H4	—	NOT USED	—
H5	—	NOT USED	—

BB 65

FRONT DOOR CONNECTORS

908W-9

I/P-
F/CROSS BODY

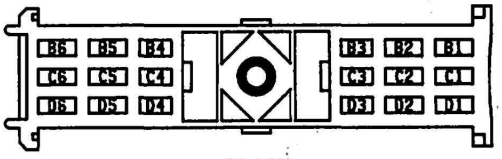


CAV	INSTRUMENT PANEL CIRCUITS		SHEET
A1	X52 18DB/WT*	RIGHT REAR SPEAKER FEED	53
A2	X58 18DB/OR*	RIGHT REAR SPEAKER RETURN	53
A3	X51 18BR/YL*	LEFT REAR SPEAKER FEED	53
A4	X57 18BR/LB*	LEFT REAR SPEAKER RETURN	53
A5	—	NOT USED	—
A6	G11 20WT/BK*	SEATBELT WARNING LAMP	26,31
A7	G04 20DB	FUEL GAUGE	10,14
A8	—	NOT USED	—
A9	G44 22VT/WT*	FUEL USAGE	10,14
A10	G75 22TN	LEFT FRONT DOOR AJAR LAMP	48
A11	G74 22TN/RD*	RIGHT FRONT DOOR AJAR LAMP	48
A12	G77 22TN/OR*	LEFT REAR DOOR AJAR LAMP	48
A13	G76 22TN/YL*	RIGHT REAR DOOR AJAR LAMP	48
A14	G80 20VT/BK*	TONE LINE	48
A15	L12 20VT/TN*	DIMMER SWITCH FEED	48
A16	M10 20OR/LG*	LIGHTED VISOR FEED	30
A17	M02 20YL	SWITCHED GROUND	30
B1	F72 14RD/YL*	FUSED IGN 'C'	23
B2	R05 12RD/LG*	FUSED BATTERY	25
B3	L90 18DB/RD*	PARK,TAIL,SIDE MARKER LPS	18,39
B4	L50 18WT/TN* L50 18WT/TN*	BRAKE SWITCH STOP LAMP SWITCH	24,32, 37
B5	C15 12BK/WT*	REAR WINDOW DEFOGGER	42
B6	G07 20WT/OR*	SPEED SIGNAL	10,14, 24
C1	G47 22BR/YL*	TAIL LAMP OUTAGE	39
C2	—	NOT USED	—
C3	L73 16PK/WT*	LEFT BRAKE SIGNAL	38,39
C4	L10 18BR/LG*	INJECTOR #5	39
C5	Z05 12BK/LB*	GROUND	30
C6	P02 18BK/WT*	TRUNK LOCK SWITCH	32
D1	G46 22LB/BK*	BRAKE LAMP OUTAGE	39,70
D2	L16 12RD/BK*	TAIL LAMP LIGHTING	18,39
D3	F87 18WT/BK*	FUSED FEED	25
D4	L74 16PK/BK*	RIGHT BRAKE SIGNAL	38,39
D5	L15 12RD/OR*	TAIL LAMP LIGHTING	18,39
D6	F81 12TN	SWITCH FEED	43,50
E1	X56 18DB/RD*	RIGHT FRONT SPEAKER RETURN	51
E2	X54 18VT	RIGHT FRONT SPEAKER FEED	51
E3	X53 18DG	LEFT FRONT SPEAKER FEED	51
E4	X55 18BR/RD*	LEFT FRONT SPEAKER RETURN	51
E5	—	NOT USED	—
E6	M01 20PK	FUSED BATTERY 'A'	41,45
E7	F73 20RD/WT* F73 20RD/WT*	FUSED BATTERY FEED	2
E8	F87 18WT/BK*	FUSED IGNITION FEED	1
E9	—	NOT USED	—
E10	G10 20LG	SEATBELT SWITCH	31
E11	M09 20YL/OR* M09 20YL/OR*	ILLUMINATED ENTRY DIODE	10,30, 45
E12	G16 20BK/LB*	SWITCHED GROUND	26,30
E13	M02 20YL	SWITCHED GROUND	30



BLACK

CAV	FRONT CROSSBODY CIRCUITS		SHEET
A1	X52 18DB/WT*	RIGHT REAR SPEAKER	52
A2	X58 18DB/OR*	RIGHT REAR SPEAKER	52
A3	X51 18BR/YL*	LEFT REAR SPEAKER	52
A4	X57 18BR/LB*	LEFT REAR SPEAKER	52
A5	—	NOT USED	—
A6	G11 20WT/BK*	SEATBELT WARNING LAMP	26,31
A7	G04 20DB	FUEL GAUGE SIGNAL	10,14
A8	—	NOT USED	—
A9	G44 20VT/WT*	TRIP COMPUTER	10,14,28
A10	G75 20TN	LEFT FRONT DOOR AJAR LAMP	48
A11	G74 20TN/RD*	RIGHT FRONT DOOR AJAR LAMP	48
A12	G77 20TN/OR*	LEFT REAR DOOR AJAR LAMP	48
A13	G76 20TN/YL*	RIGHT REAR DOOR AJAR LAMP	48
A14	G80 20VT	WARNING TONE	26
A15	L12 18VT/TN*	HAZARD FLASHER	48
A16	M10 18OR/LG*	RIGHT LIGHTED VISOR	30
A17	M02 18YL	SWITCHED GROUND	30



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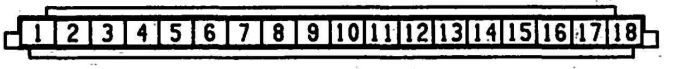
CAV	FRONT CROSSBODY CIRCUITS		SHEET
B1	F72 14RD/YL*	BATTERY	48,49
B2	R05 12RD/LG*	FUSED BATTERY	25
B3	L90 14DB/RD*	PARK,TAIL,SIDE MARKER LPS	18,39
B4	L50 18WT/TN*	REAR WINDOW DEFOGGER	24,32,37
B5	C15 12BK/WT*	REAR WINDOW DEFOGGER	42
B6	G07 20WT/OR*	SPEED SIGNAL	10,14,24
C1	G47 20BR/YL*	TAIL LAMP OUTAGE	39,70
C2	—	NOT USED	—
C3	L73 14PK/WT*	LEFT BRAKE SIGNAL	38,39
C4	L10 18BR/LG*	BACK-UP LAMPS	39
C5	Z01 12BK	GROUND	29,30,32
C6	P02 18BK/WT*	TRUNK LOCK SWITCH	32
D1	G46 20LB/BK*	BRAKE LAMP OUTAGE	39,70
D2	L16 12RD/BK*	TAIL LAMP LIGHTING	18,39
D3	F87 18WT/BK*	IGNITION FROM VOM	39
D4	L74 14PK/BK*	RIGHT BRAKE SIGNAL	38,39
D5	L15 12RD/OR*	TAIL LAMP LIGHTING	18,39
D6	F81 12TN	WINDOW SWITCH FEED	43,50



LT GRAY

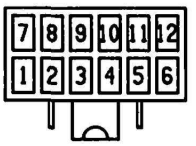
CAV	FRONT CROSSBODY CIRCUITS		SHEET
E1	X56 18DB/RD*	RIGHT DOOR SPEAKER	51
E2	X54 18VT	LEFT DOOR SPEAKER	51
E3	X53 18DG	LEFT DOOR SPEAKER	51
E4	X55 18BR/RD*	LEFT DOOR SPEAKER	51
E5	—	NOT USED	—
E6	M01 18PK	FUSED BATTERY "A"	29
E7	F73 20RD/WT*	FUSED BATTERY	26
E8	F87 18RD/BK*	FUSED IGNITION	26
E9	Z01 12BK	GROUND	30,31,51
E10	G10 20LG	SEATBELT SWITCH	31
E11	M09 20DB/OR*	ILLUMINATED ENTRY	10,30,45
E12	G16 20BK/LB*	SWITCHED GROUND	26,30
E13	M02 20YL	SWITCHED GROUND	30

I/P TO FRONT
CROSSBODY INTERCONNECT

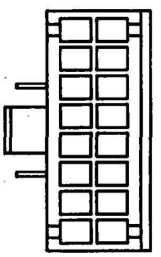


CAV	VMM CIRCUITS		SHEET
1	F60 22RD/WT*	FUSED BATTERY 'A'	46
2	G29 22BK/TN*	LOW WASHER FLUID	33
3	G18 22PK/LB*	LOW COOLANT LAMP	37
4	G61 22LB/WT*	OIL LEVEL SENDER	16
5	F83 22YL/DG*	FUSED IGNITION 'B'	36
6	G74 22TN/RD*	RIGHT FRONT DOOR AJAR LAMP	48
7	G75 22TN	LEFT FRONT DOOR AJAR LAMP	48
8	G76 22TN/YL*	RIGHT REAR DOOR AJAT LAMP	48
9	G77 22TN/OR*	LEFT REAR DOOR AJAR LAMP	48
10	G68 22PK/OR*	TRANS WARNING LAMP	10,14
11	G67 22GY	SPEED SIGNAL	10,14
12	G47 22BR/YL*	TAIL LAMP OUTAGE	39
13	G46 22LB/BK*	BRAKE LAMP OUTAGE	39
14	G81 22DB/RD*	TONE LINE	31
15	Z01 22BK	GROUND	28
16	E20 22OR/DG*	LCD BACKLITE	51
17	G25 22LG/BK*	ENGLISH/METRIC	28
18	Z02 22BK/LG*	SENSOR GROUND	10,14

CAV	PASSIVE RESTRAINT CIRCUITS		SHEET
1	Z01 18BK	GROUND	25
2	–	NOT USED	–
3	–	NOT USED	–
4	R17 20DB/YL*	CARR SW RR POS (RT)	25
5	R28 20LB/BK*	RETRACTOR SWITCH (PASS)	25
6	R27 20YL/BK*	RETRACTOR SWITCH (DRIVER)	25
7	–	NOT USED	–
8	R06 18DG/RD*	B+ FOR MODULE	26
9	–	NOT USED	–
10	–	NOT USED	–
11	G07 20WT/OR*	SPEED SIGNAL	10,24,26
12	R30 18BR/OR*	RIGHT FRONT DOOR JAMB SWITCH	26,30



CAV	PASSIVE RESTRAINT CIRCUITS		SHEET
21	R16 20LG	CARR SW FT POS (RT)	25
22	–	NOT USED	–
23	R24 20VT	RIGHT REAR MOTOR RELAY	25
24	R26 20VT/WT*	LEFT REAR MOTOR RELAY	26
25	R23 20GY	RIGHT FRONT MOTOR RELAY	25
26	–	NOT USED	–
27	R18 20DG	CARR SW FT POS (LT)	26
28	R19 20LB/WT*	CARR SW FT POS (LT)	26
29	–	NOT USED	–
30	F87 18WT/BK*	FUSED IGNITION 'C'	26
31	–	NOT USED	–
32	D10 20PK/WT*	DIAGNOSTIC	26
33	G11 20WT/BK*	SEATBELT WARNING LAMP	26,31
34	G80 20VT/BK*	WARNING TONE	26
35	G16 20BK/LB*	LEFT FRONT DOOR JAMB	26,30
36	R25 20GY/WT*	LEFT PASSENGER RELAY	26



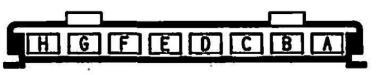
BB 69 PASSIVE RESTRAINT MODULE CONNECTORS 908W-9

CAV	E.E.C CIRCUITS		SHEET
A	G07 20WT/OR*	SPEED SIGNAL	10
B	K86 20RD/LB*	SPEED SENSOR	9
C	K87 20RD/BK*	SPEED SENSOR	9
D	K61 20YL/BK*	ECU A/C OUT	7,11
E	G08 20LB/BK*	FUEL FLOW	10,28
F	C91 20LB	A/C REQUEST	10
G	C90 20LG	A/C SELECT	10
H	Z23 20BK/LG*	GROUND	10



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CAV	INSTRUMENT PANEL CIRCUITS		SHEET
A	G07 20WT/OR*	ROAD SPEED TO ENGINE	10
B	K86 20RD/LB*	ROAD SPEED FROM TRANS	9
C	K87 20RD/BK*	ROAD SPEED FROM TRANS	9
D	K61 20YL/BK*	CHECK FOR LOW PRESSURE	7,11
E	G08 20LB/BK*	FUEL FLOW	10,28
F	C91 20LB	A/C RELAY	10
G	C90 20LG	A/C SELECT	10
H	Z23 20BK/LG*	GROUND	10

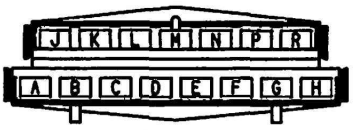


WHITE



BLACK

CAV	POWER CIRCUITS		SHEET
A	—	NOT USED	—
B	—	NOT USED	—
C	—	NOT USED	—
D	—	NOT USED	—
E	—	NOT USED	—
F	—	NOT USED	—
G	—	NOT USED	—
H	—	NOT USED	—
J	V03 12BR/WT*	WIPER-LOW SPEED	34
K	V04 12RD	WIPER-HI SPEED	34
L	V24 12BR/OR*	WIPER MOTOR	34
M	A06 16RD/OR*	IGNITION FEED	31,41,46,48
N	A28 12YL	START & RUN	4,6
P	A38 14OR	RUN	35
R	G18 20PK/BK*	LOW COOLING FLUID SWITCH	37

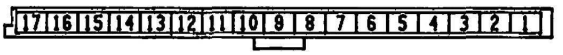


WHITE

CAV	INSTRUMENT PANEL CIRCUITS		SHEET
A	V05 14DG/YL*	WIPER CONTROL	34
B	V03 12BR/WT*	WIPER LOW SPEED	34
C	V51 16WT	INTERMITTENT WIPER	34
D	V04 12RD	WIPER HIGH SPEED	34
E	F86 12LG/BK*	FUSED IGN 'O'	34
F	V11 18BK/TN*	WASHER PUMP	34
G	V50 16LG	INTERMITTENT WIPER-ADJ	34
H	—	NOT USED	—
J	V03 12BR/WT*	WIPER-LOW SPEED	34
K	V04 12RD	WIPER-HI SPEED	34
L	V24 12BR/OR*	INTERMITTENT FUNCTION	34
M	A06 16RD/OR*	WIPER FEED	31,41,46,48
N	A28 12YL	IGNITION START & RUN	4,6
P	A38 14OR	IGNITION 3 RUN	35
R	G18 20PK/BK*	LOW COOLANT LAMP	37

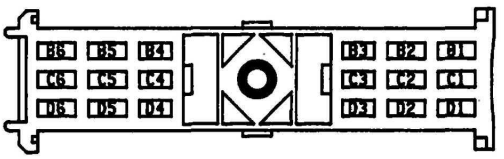
BB 71 POWER CIRCUIT TO I/P INTERCONNECT 908W-9

CAV	ENGINE CIRCUITS		SHEET
A1	L61 16LG	LEFT FRONT SIGNAL	20,37
A2	L60 16TN	RIGHT FRONT SIGNAL	20,37
A3	G17 20BR	UPSHIFT LAMP TO E.E.C.	9
A4	—	NOT USED	—
A5	C13 20DB/WT*	A/C CLUTCH RELAY	35
A6	G61 22LB/WT*	OIL LEVEL SENSOR	16
A7	G21 18GY/LB*	TACH SIGNAL	6,9,13
A8	G68 20PK/OR*	TRANS WARNING LAMP	10,14
A9	—	NOT USED	—
A10	—	NOT USED	—
A11	G29 22BK/TN*	WASHER FLUID LEVEL SENSOR	33
A12	G82 22BK/LB*	EXT TEMP SENSOR GROUND	28
A13	G31 22VT/LG*	EXT TEMP SENSOR SIGNAL	28
A14	F84 18YL/WT*	FUSED B+ TO TRANS	1,23
A15	—	NOT USED	—
A16	C21 20DB/OR*	A/C LOW PRESSURE SWITCH	35
A17	V36 20TN/RD*	VENT VALVE	23



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CAV	ENGINE CIRCUITS		SHEET
B1	—	NOT USED	—
B2	V30 20DB/RD*	BRAKE SWITCH	23
B3	G60 20GY/YL*	OIL PRESSURE GAUGE SIGNAL	16
B4	G12 20TN/BK*	ALTERNATOR LAMP	4
B5	L03 16RD/OR*	HIGH BEAM HEADLAMPS	20,22
B6	T41 20BK/WT*	NEUTRAL SAFETY	5,23
C1	L04 16VT/WT*	LOW BEAM HEADLAMPS	22
C2	F34 14TN/BK*	LOW BEAM RELAY	22
C3	G34 16RD/GY*	D.R.L. MODULE	22
C4	G06 20GY	OIL PRESSURE LAMP	16
C5	G09 20GY/BK* G09 20GY/BK*	BRAKE LAMP TO E.E.C. BRAKE LAMP TO BODY	37 37
C6	—	NOT USED	—
D1	—	NOT USED	—
D2	Z02 14BK/LG* Z02 14BK/LG*	SENSOR GROUND SENSOR GROUND TO BODY	10,14,16 16
D3	M01 18BK/TN* M01 18BK/TN*	COURTESY LAMPS TO E.E.C. COURTESY LAMPS TO BODY	29 29
D4	G20 20VT/YL*	TEMP GAUGE SIGNAL TO E.E.C.	16
D5	Z01 12BK	GROUND	20,30,38
D6	V35 20LG/RD*	CHARGE VALVE	23

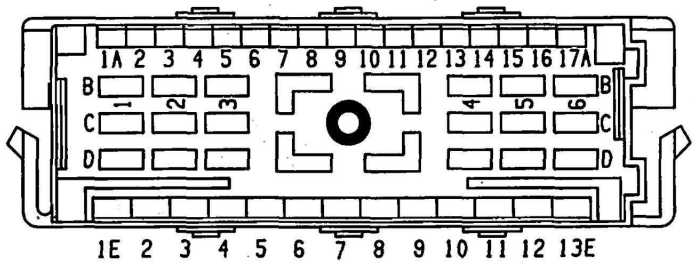


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CAV	ENGINE CIRCUITS		SHEET
E1	F83 20YL/DG*	FUSED IGNITION 'B'	36
E2	G02 20VT	COOLANT TEMP LAMP TO E.E.C.	16
E3	—	NOT USED	—
E4	C08 20DG/RD*	AMBIENT TEMP SENSOR	35
E5	—	NOT USED	—
E6	X02 14DG/RD*	HORNS	27
E7	Z07 20BK/RD*	A/C LOW PRESSURE GROUND	35
E8	V11 18BK/TN*	WASHER PUMP MOTOR	33
E9	V55 14TN/RD*	PARK SWITCH RETURN TO E.E.C.	33
E10	—	NOT USED	—
E11	—	NOT USED	—
E12	V06 14DB	PARK SWITCH FEED TO E.E.C.	33
E13	L01 18VT/BK*	BACK UP LAMPS	39



LT GRAY



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CAV	INSTRUMENT PANEL CIRCUITS		SHEET
A1	L61 16LG	LAMP MODULE - C12	20,37
A2	L60 16BR	LAMP MODULE - C13	20,37
A3	G17 20TN	UPSHIFT LAMP	9
A4	—	NOT USED	—
A5	C13 20DB/YL*	HEVAC MODULE - D1	35
A6	G61 22LB/WT*	VMM - 4	16
A7	G21 18GY/LB*	TACH SIGNAL	13,27,31
A8	G68 20PK/OR*	VMM - 10	6,9,13
A9	—	NOT USED	—
A10	—	NOT USED	—
A11	G29 22BK/TN*	VMM - 2	33
A12	G82 22BK/LB*	TRIP COMPUTER - 9	28
A13	G31 22VT/LG*	TRIP COMPUTER - 6	28
A14	F84 18YL/WT*	FUSED B+ TO TRANS	1,23
A15	—	NOT USED	—
A16	C21 20DB/OR*	HEVAC MODULE - C8	35
A17	V36 20TN/RD*	CRUISE MODULE - VENT	23
B1	—	NOT USED	—
B2	V30 20DB/RD*	BRAKE SWITCH	23
B3	G60 20GY/YL*	OIL PRESSURE GAUGE	16
B4	G12 20TN/BK*	ALTERNATOR LAMP	4
B5	L03 16RD/OR*	HIGH BEAM HEADLAMPS	20,22
B6	T41 20BK/WT*	NEUTRAL SAFETY	5,23
C1	L04 16VT/WT*	LOW BEAM HEADLAMPS	20,22
C2	F34 14TN/BK*	LOW BEAM RELAY	22
C3	G34 16RD/GY*	D.R.L. MODULE	22
C4	G06 20GY	OIL PRESSURE LAMP	16
C5	G09 20GY/BK*	BRAKE LAMP	37
C6	—	NOT USED	—
D1	—	NOT USED	—
D2	Z02 14BK/LG*	SENSOR GROUND	10,14,16,18
D3	M01 18PK	COURTESY LAMPS	29
D4	G20 20VT/YL*	TEMP GAUGE	16
D5	Z01 12BK	GROUND	20,30,39
D6	V35 20LG/RD*	CRUISE MODULE - CHARGE	23
E1	F83 20YL/BK*	FUSED IGNITION 'B'	36
E2	G02 20VT	COOLANT TEMP LAMP	16
E3	—	NOT USED	—
E4	C08 20DG/RD*	HEVAC MODULE - C13	35
E5	—	NOT USED	-
E6	X02 14DG/RD*	HORN RELAY	27
E7	Z07 20BK/RD*	SENSOR GROUND	35
E8	V11 18BK/TN*	WIPER MODULE	33
E9	V55 14TN/RD*	WIPER MODULE	33
E10	—	NOT USED	—
E11	—	NOT USED	—
E12	V06 14DB	WIPER MODULE	33
E13	L01 18VT/BK*	BACK UP LAMPS	39

ENGINE TO I/P INTERCONNECT

ENGINES

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GENERAL INFORMATION

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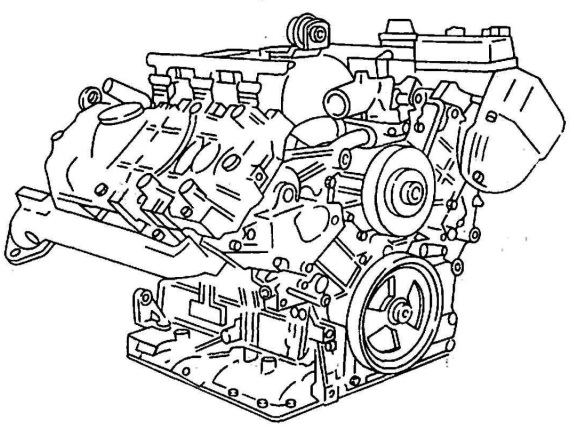
3.0L ENGINE

The 3.0 liter (182 CID) six-cylinder engine is a V-Type lightweight, overhead valve engine (Fig. 1).

This engine is designed for unleaded fuel. The cylinder head has hemispherical combustion chambers with raised intake manifold ports and large valves which optimize power and efficiency.

The cylinders are numbered 1 through 3 from rear to front on the left bank. The cylinders are numbered 4 through 6 from rear to front on the right bank. The firing order is 1-6-3-5-2-4 (Fig. 2).

The crankshaft rotation is clockwise, when viewed from the front of the engine. The crankshaft rotates within four (4) main bearings and the camshaft rotates within four (4) line-bored bearings. There are two camshafts in the 3.0L engine.



E8909-238

Fig. 1—3.0L Six-Cylinder Engine

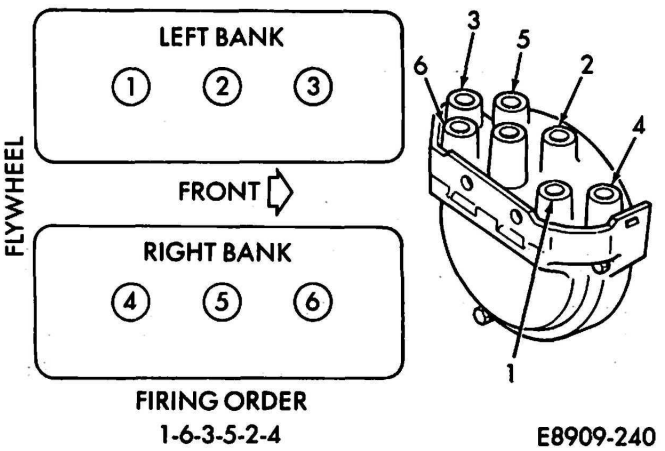


Fig. 2—3.0L Engine Firing Order

TYPE	6 CYLINDER — 90 DEGREE V-BLOCK
BORE AND STROKE	93 x 73 mm (3.66 x 2.87 INCH)
DISPLACEMENT	3.0 LITER (182 CU. INCH)
COMPRESSION RATIO	9.3 : 1
TORQUE	232 N·m (171 FT.-LBS.) @ 3750 RPM
FIRING ORDER	1-6-3-5-2-4
LUBRICATION	PRESSURE FEED-FULL FLOW FILTRATION
ENGINE OIL CAPACITY	5.7 LITERS (6 QUARTS)
COOLING SYSTEM	LIQUID COOLED-FORCED CIRCULATION
COOLING SYSTEM CAPACITY	8.2 LITER (8.6 QUARTS)
CYLINDER BLOCK	ALUMINUM ALLOY
CRANKSHAFT	FORGED STEEL — JOURNAL OFFSET 30°
CYLINDER HEAD	ALUMINUM ALLOY
CAMSHAFT	STEEL
PISTONS	ALUMINUM ALLOY
PISTON COMBUSTION CAVITY	HEMISPHERICAL
CONNECTING RODS	CAST NODULAR IRON

E8909-241

Fig. 3—3.0L Engine Description

3.0L Engine Identification Code

The engine identification number is stamped onto the right-hand side of the cylinder block valley below the intake manifold (Fig. 5).

The engines also have an additional identification number (consisting of the last 8 digits of the VIN), located on the engine block (Fig. 6).

YEAR OF BUILD 1ST DIGIT	MONTH OF BUILD 2ND & 3RD DIGITS
0 = 1990	01-JANUARY 02-FEBRUARY ETC.
ENGINE TYPE 4TH & 5TH DIGITS	**DAY OF BUILD 6TH & 7TH DIGITS**
UX*	1-31
*UX = MULTIPOINT FUEL INJECTION V-6	
EXAMPLE: 004UX13 ENGINE BUILT ON 13 APRIL '90	

9009-92

Fig. 4—Engine Identification Code (Build Date Code)

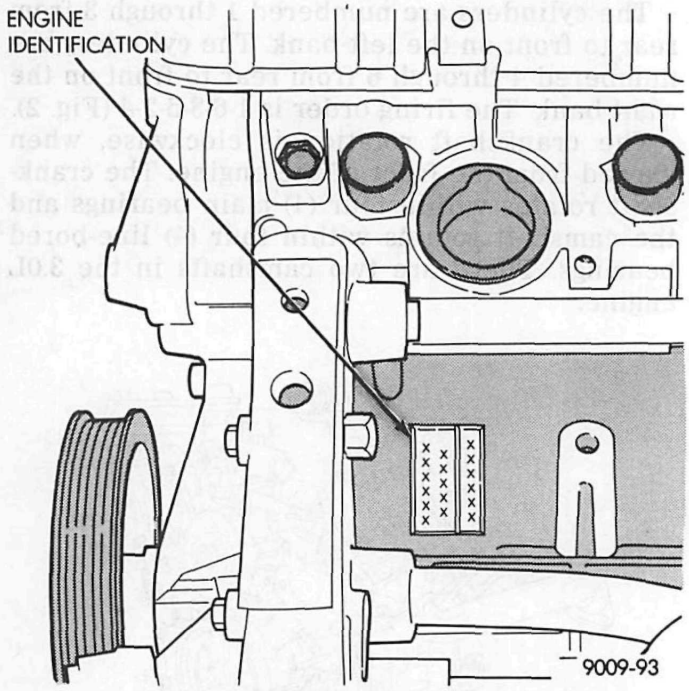


Fig. 5—Engine Identification Under Intake Manifold

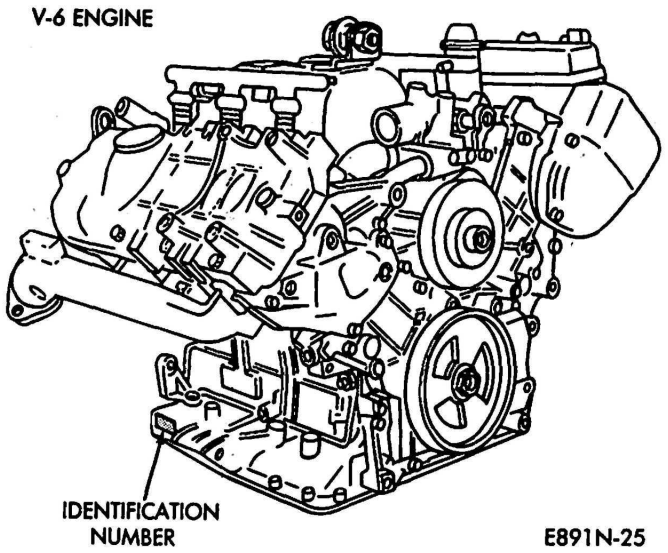


Fig. 6—Additional Identification Number Location

CODE	COMPONENT	UNDERSIZE
P	One or more connecting rod bearing journals	0.254 mm (0.010 in)
M	All crankshaft main bearing journals	0.254 mm (0.010 in)
PM	All crankshaft main bearing journals and one or more connecting rod journals	0.254 mm (0.010 in)
CODE	**COMPONENT**	**OVERSIZE**
B	All cylinder bores	0.254 mm (0.010 in)
C	All camshaft bearing bores	0.254 mm (0.010 in)

J8909-54

Fig. 7—Oversize/Undersize Component Codes

MEASURING WITH PLASTIC-GAGE

Engine crankshaft bearing clearances can be determined by use of Plastic-Gage or equivalent. The following is the recommended procedures for the use of Plastic-Gage:

(1) Remove oil film from surface to be checked. Plastic-Gage is soluble in oil.

(2) The total clearance of the **main bearings** can only be determined by removing the weight of the crankshaft. This can be accomplished by either of two methods:

(a) **Preferred Method**—Shimming the bearings adjacent to the bearing to be checked in order to remove the clearance between upper bearing shell and the crankshaft. This can be accomplished by placing a minimum of 0.254 mm (0.010 inch) shim between the bearing shell and the bearing cap on the adjacent bearings and tighten the bolts to 14-20 N·m (10-15 ft-lbs) torque. When checking #1 main bearing, shim #2 main bearing. When checking #2 main bearing, shim #1 and #3 main bearing. Follow the same pattern for the rest of the main bearings. **Remove all shims before reassembling engine.**

(b) **Alternative Method**—The weight of the crankshaft is supported by a jack under the counterweight adjacent to the bearing being checked.

(3) Place a piece of Plastic-Gage across the entire width of the bearing shell in the cap approximately 6.35 mm (1/4 inch) off center and away from the oil holes (Fig. 8). In addition, suspect areas can be checked by placing the Plastic-Gage in the suspect area. Tighten the bearing cap bolts of the bearing being checked to the proper torque.

The checking of connecting rod clearances does not require shimming of the crankshaft. However, before assembling the rod cap with Plastic-Gage in place, the crankshaft must be turned until the connecting rod to be checked starts moving toward the top of the engine. Only then should the cap be assembled and tightened to the proper torque. Do not rotate the crankshaft while assembling the cap or the Plastic-Gage may be smeared, giving inaccurate results.

(4) Remove the bearing cap and compare the width of the flattened Plastic-Gage with the metric scale provided on the package (Fig. 9). Locate the band closest to the same width, this band shows the amount of clearance in thousandths of a millimeter. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Refer to "Engine Specifications" at the end of this section. Plastic-Gage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.

(5) Plastic-Gage is available in a variety of clearance ranges. The 0.025-0.076 mm (0.001-0.003 inch) is usually the most appropriate for checking engine bearing proper specifications.

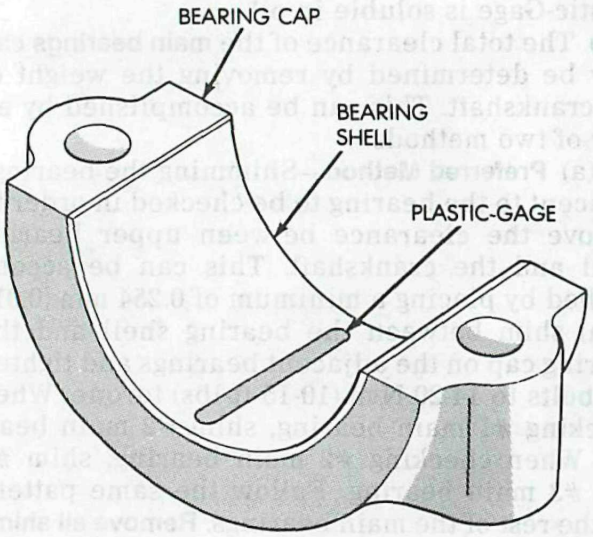


Fig. 8—Placement of Plastic-Gage in Bearing Shell

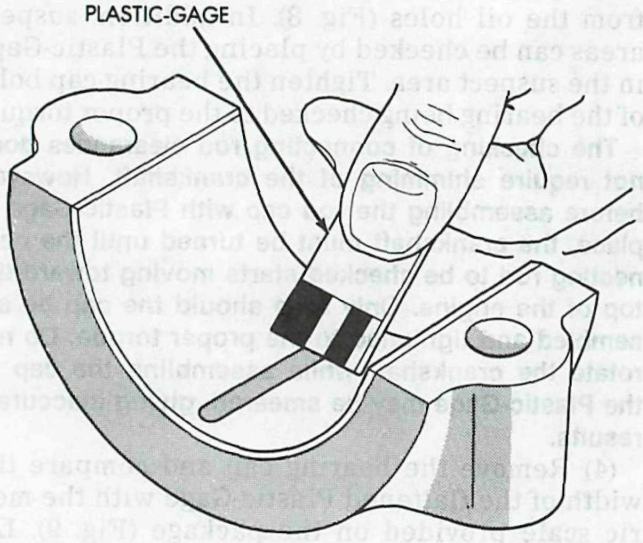


Fig. 9—Clearance Measurement

REPAIR OF DAMAGED OR WORN THREADS

Damaged or worn threads can be repaired. Essentially, this repair consists of drilling out worn or damaged threads, tapping the hole with a special Heli-Coil Tap, (or equivalent), and installing an insert into the tapped hole. This brings the hole back to its original thread size.

Heli-Coil tools and inserts are readily available from automotive parts jobbers.

ENGINE DIAGNOSIS

INDEX

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Cylinder Compression Pressure Test	5
Cylinder Head Gasket Failure Diagnosis	5

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine tune-ups.

Refer to the Service Diagnosis—Mechanical chart for possible causes and corrections of malfunctions. Refer to Group 14, "Fuel System" for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts.

Information concerning additional tests and diagnosis is provided within the following diagnosis:

- Cylinder Compression Pressure Test.
- Cylinder Head Gasket Failure Diagnosis.

CYLINDER COMPRESSION PRESSURE TEST

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

(1) Clean the spark plug recesses with compressed air.

(2) Remove the spark plugs.

(3) Secure the throttle in the wide-open position.

(4) Insert a compression pressure gauge and rotate the engine with the starter motor for three revolutions.

(5) Record the compression pressure on the third revolution. Continue the test for the remaining cylinders.

(6) Refer to the Specifications chart for the correct engine compression pressures.

CYLINDER HEAD GASKET FAILURE DIAGNOSIS

A leaking cylinder head gasket usually results in a loss of power, loss of coolant and engine misfire.

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

A cylinder head gasket leaking between two adjacent cylinders is indicated by a loss of power and/or engine misfire.

A cylinder head gasket leaking between a cylinder and an adjacent water jacket is indicated by coolant foaming or overheating and loss of coolant.

Cylinder-to-Cylinder Leakage Test

To determine if a cylinder head gasket is leaking between any two adjacent cylinders, follow the procedures outlined in Cylinder Compression Pressure Test. A cylinder head gasket leaking between two adjacent cylinders will result in approximately a 50-70% reduction in compression pressure (in comparison to the other cylinders) in the two affected cylinders.

Cylinder-to-Water Jacket Leakage Test

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

(1) Remove the radiator cap.

(2) Start the engine and allow it to warm up until the thermostat opens.

(3) If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

(4) If bubbles are not visible, install a radiator pressure tester and pressurize the coolant system.

(5) If a cylinder is leaking combustion pressure into the water jacket, the tester pointer will pulsate with every combustion stroke of the cylinder.

MECHANICAL DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE OIL CONSUMPTION	(1) OIL LEAKS.	(1) REPAIR OIL LEAKS.
	(2) CLOGGED OIL VAPOR RECIRCULATION SYSTEM.	(2) CLEAN SYSTEM, CHECK ALL ORIFICES FOR CORRECT CALIBRATION AND CONDITION.
	(3) WORN VALVE STEM SEALS.	(3) REPLACE VALVE STEM SEALS.
	(4) WORN VALVE STEMS.	(4) CHECK VALVE STEM TO GUIDE CLEARANCE. REPAIR AS NECESSARY.
	(5) WORN OR DAMAGED PISTON RINGS.	(5) CHECK PISTON RINGS. REPAIR AS NECESSARY.
	(6) LEAK BETWEEN VALVE GUIDE AND CYLINDER HEAD.	(6) PRESSURE CHECK HEAD TO ENSURE LEAKAGE BETWEEN HEAD AND GUIDE. REPLACE AS NECESSARY.
	(7) LOOSE CYLINDER HEAD BOLTS.	(7) REPLACE CYLINDER HEAD GASKET. TIGHTEN CYLINDER HEAD TO SPEC.
FUEL MILEAGE	CHECK THESE CONDITIONS BEFORE USING THE DRB II™	
	(1) ENGINE VACUUM LEAKS.	(1) REPAIR AS NECESSARY.
	(2) FUEL LEAKS.	(2) REPAIR AS NECESSARY.
	(3) CLOGGED EXHAUST SYSTEM.	(3) REPAIR AS NECESSARY.
	(4) EXHAUST SYSTEM LEAKS.	(4) REPAIR AS NECESSARY.
	(5) LOW COMPRESSION.	(5) REPAIR AS NECESSARY.
	(6) BRAKES DRAGGING.	(6) REPAIR AS NECESSARY.
	(7) CLOGGED AIR INTAKE SYSTEM.	(7) REPAIR AS NECESSARY.
	(8) CLOGGED AIR FILTER ELEMENT.	(8) REPLACE AIR FILTER ELEMENT.
LOW COMPRESSION	(1) PISTON RINGS NOT SEALING.	(1) REPLACE RINGS.
	(2) LEAKING VALVE, VALVE SEAT.	(2) GRIND/REPLACE VALVES AND SEATS.
	(3) PISTON OR CYLINDER WORN.	(3) REPLACE PISTON AND LINER ASSEMBLY.
	(4) BLOWN CYLINDER HEAD GASKET.	(4) REPLACE CYLINDER HEAD GASKET.

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MECHANICAL DIAGNOSIS (CONT.)

CONDITION	POSSIBLE CAUSE	CORRECTION
HIGH OIL PRESSURE	(1) OIL PRESSURE RELIEF VALVE STUCK IN CLOSED POSITION.	(1) REPAIR RELIEF VALVE.
LOW OIL PRESSURE	(1) LOW ENGINE OIL LEVEL.	(1) CHECK ENGINE OIL LEVEL. FILL AS NECESSARY.
	(2) CLOGGED OIL FILTER OR FILTER SUPPLY/RETURN LINES.	(2) REPLACE CLOGGED COMPONENT.
	(3) WORN OIL PUMP GEARS OR WORN OIL PUMP BODY BORES.	(3) REPLACE THE OIL PUMP.
	(4) EXCESSIVE TAPPET TO BORE CLEARANCE.	(4) CHECK BORE SIZE & TAPPET SIZE. REPAIR AS NECESSARY.
	(5) OIL PRESSURE RELIEF VALVE STUCK OPEN.	(5) REPAIR OIL PRESSURE RELIEF VALVE.
	(6) THIN OIL — DILUTED.	(6) CHANGE ENGINE OIL AND FILTER. USE SPECIFIED VISCOSITY OIL.
	(7) EXCESSIVE BEARING CLEARANCE (CAMSHAFT, CONNECTING ROD OR MAIN BEARINGS).	(7) REPLACE BEARINGS. WORN CAMSHAFT BEARINGS — REPLACE THE CYLINDER HEAD(S).
	(8) LOOSE OIL GALLEY PLUG.	(8) TIGHTEN/REPLACE OIL GALLEY PLUG.
CONNECTING ROD OR CRANKSHAFT MAIN BEARING NOISE	(1) EXCESSIVE BEARING CLEARANCE.	(1) REPLACE BEARINGS.
	(2) THIN OIL — DILUTED OIL.	(2) REPLACE OIL WITH SPECIFIED VISCOSITY — REPLACE FILTER.
	(3) LOW OIL PRESSURE.	(3) SEE LOW OIL PRESSURE SECTION.
	(4) LOW OIL SUPPLY.	(4) CHECK OIL LEVEL.

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MECHANICAL DIAGNOSIS (CONT.)

CONDITION	POSSIBLE CAUSE	CORRECTION
VALVE CLATTER (NOISY VALVES)	(1) LOW ENGINE OIL LEVEL.	(1) FILL TO CORRECT OIL LEVEL.
	(2) WORN VALVE GUIDE OR VALVE STEM.	(2) REPLACE VALVE AND/OR REPAIR VALVE GUIDE.
	(3) THIN OIL — DILUTED OIL.	(3) REPLACE OIL WITH SPECIFIED VISCOSITY. REPLACE OIL FILTER.
	(4) WORN ROCKER ARMS AND/OR ROCKER ARM PIVOTS.	(4) REPLACE ROCKER ARMS AND/OR PIVOTS.
	(5) BENT VALVE.	(5) REPLACE VALVE.
	(6) BROKEN VALVE SPRING.	(6) REPLACE SPRING.
	(7) TAPPET FACE WORN.	(7) REPLACE TAPPET. CHECK THE CORRESPONDING CAMSHAFT LOBE FOR WEAR.
	(8) LOW OIL PRESSURE.	(8) SEE LOW OIL PRESSURE DIAGNOSIS CHART.
ENGINE OVERHEATING	(1) LOOSE OR BROKEN DRIVE BELT.	(1) TENSION OR REPLACE THE DRIVE BELT.
	(2) FAULTY OPERATING THERMOSTAT.	(2) REPLACE THERMOSTAT.
	(3) LOW ENGINE COOLANT LEVEL.	(3) FILL COOLANT SYSTEM.
	(4) ANTI-FREEZE CONCENTRATION TOO HIGH.	(4) CORRECT CONCENTRATION LEVEL.
	(5) FAULTY OPERATING WATER PUMP.	(5) REPLACE WATER PUMP.
	(6) COOLING FANS NOT OPERATING.	(6) REFER TO GROUP 07 "COOLING".
	(7) RADIATOR DAMAGE OR CORE BLOCKAGE.	(7) REPAIR OR REMOVE CORE BLOCKAGE.
	(8) DAMAGED CYLINDER HEAD GASKET.	(8) REPLACE GASKET. CHECK CYLINDER HEAD FOR WARPAGE.
	(9) CRACKED CYLINDER HEAD OR CYLINDER BLOCK.	(9) REPLACE CRACKED COMPONENT.
	(10) FAULTY EXPANSION CAP VALVE.	(10) REPLACE EXPANSION CAP.
	(11) WATER PASSAGES CLOGGED WITH RUST OR CORROSION.	(11) CLEAN PASSAGES.
	(12) ACCESSORY DRIVE BELT INCORRECTLY ROUTED CAUSING WATER PUMP TO RUN BACKWARDS.	(12) ROUTE BELT CORRECTLY.

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MECHANICAL DIAGNOSIS (CONT.)

CONDITION	POSSIBLE CAUSE	CORRECTION
LOW COMPRESSION	(1) PISTON RINGS NOT SEALING.	(1) REPLACE RINGS.
	(2) LEAKING VALVE, VALVE SEAT.	(2) REGRIND/REPLACE VALVES AND SEATS.
	(3) WORN VALVE GUIDE.	(3) REPAIR GUIDES.
	(4) PISTON OR CYLINDER WORN.	(4) REPLACE PISTON AND LINER ASSEMBLY.
	(5) BLOWN CYLINDER HEAD GASKET (COULD BE CAUSED BY IMPROPER LINER PROTRUSION, WARPED CYLINDER HEAD).	(5) REPLACE CYLINDER HEAD GASKET. CHECK LINER PROTRUSION, CYLINDER HEAD WARPAGE.
HIGH OIL PRESSURE	(1) OIL PRESSURE RELIEF VALVE STUCK IN CLOSED POSITION.	(1) REPAIR RELIEF VALVE.
LOW OIL PRESSURE	(1) LOW ENGINE OIL LEVEL.	(1) CHECK ENGINE OIL LEVEL. FILL AS NECESSARY.
	(2) CLOGGED OIL FILTER OR FILTER SUPPLY/RETURN LINES.	(2) REPLACE CLOGGED COMPONENT.
	(3) WORN OIL PUMP GEARS OR WORN OIL PUMP BODY BORES.	(3) REPLACE THE CYLINDER BLOCK IF THE GEAR TO CASE CLEARANCE IS EXCESSIVE. IF JUST THE GEARS ARE WORN, REPLACE THE GEARS AND INSURE CORRECT GEAR TO CASE CLEARANCE.
	(4) OIL PRESSURE RELIEF VALVE STUCK OPEN.	(4) REPAIR OIL PRESSURE RELIEF VALVE.
	(5) THIN OIL — DILUTED.	(5) CHANGE ENGINE OIL AND FILTER. USE SPECIFIED VISCOSITY OIL.
	(6) EXCESSIVE BEARING CLEARANCE (CAMSHAFT, CONNECTING ROD OR MAIN BEARING).	(6) REPLACE BEARINGS. WORN CAMSHAFT BEARINGS — REPLACE THE CYLINDER HEAD(S).
	(7) LOOSE ONLY GALLEY PLUG.	(7) TIGHTEN/REPLACE OIL GALLEY PLUG.
CONNECTING ROD OR CRANKSHAFT MAIN BEARING NOISE.	(1) EXCESSIVE BEARING CLEARANCE.	(1) REPLACE BEARINGS.
	(2) THIN OIL — DILUTED OIL.	(2) REPLACE OIL WITH SPECIFIED VISCOSITY — REPLACE FILTER.
	(3) LOW OIL PRESSURE.	(3) SEE LOW OIL PRESSURE SECTION.
	(4) LOW OIL SUPPLY.	(4) CHECK OIL LEVEL.

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MECHANICAL DIAGNOSIS (CONT.)

CONDITION	POSSIBLE CAUSE	CORRECTION
VALVE CLATTER (NOISY VALVES)	(1) LOW ENGINE OIL LEVEL.	(1) FILL TO CORRECT OIL LEVEL.
	(2) WORN VALVE GUIDE OR VALVE STEM.	(2) REPLACE VALVE AND/OR VALVE GUIDE.
	(3) THIN OIL — DILUTED OIL.	(3) REPLACE OIL WITH SPECIFIED VISCOSITY. REPLACE OIL FILTER.
	(4) WORN ROCKER ARMS AND/OR ROCKER ARM SHAFTS.	(4) REPLACE ROCKER ARMS AND/OR SHAFTS.
	(5) FAULTY HYDRAULIC TAPPET OPERATION.	(5) REPAIR AS NECESSARY.
ENGINE OVERHEATING	(1) LOOSE OR BROKEN DRIVE BELT.	(1) TENSION OR REPLACE AND TENSION THE DRIVE BELT.
	(2) FAULTY OPERATING THERMOSTAT.	(2) REPLACE THERMOSTAT.
	(3) LOW ENGINE COOLANT LEVEL.	(3) FILL COOLANT SYSTEM.
	(4) ANTI-FREEZE CONCENTRATION TOO HIGH.	(4) CORRECT CONCENTRATION LEVEL.
	(5) FAULTY OPERATING WATER PUMP.	(5) REPLACE WATER PUMP.
	(6) COOLING FANS NOT OPERATING.	(6) REFER TO GROUP 07, "COOLING".
	(7) RADIATOR DAMAGE OR CORE BLOCKAGE.	(7) REPAIR OR REMOVE CORE BLOCKAGE.
	(8) DAMAGED CYLINDER HEAD GASKET.	(8) REPLACE CYLINDER HEAD GASKET. CHECK LINER PROTRUSION, CYLINDER HEAD WARPAGE.
	(9) CRACKED CYLINDER HEAD OR CYLINDER BLOCK.	(9) REPLACE CRACKED COMPONENT.
	(10) FAULTY EXPANSION CAP VALVE.	(10) REPLACE EXPANSION CAP.
	(11) WATER PASSAGES CLOGGED WITH RUST OR CORROSION.	(11) CLEAN PASSAGES.

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3.0L ENGINE SERVICE PROCEDURES

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FRONT ENGINE MOUNTS

Removal

(1) Disconnect the battery negative cable.
(2) Loosen the stud locknuts (Fig. 1).
(3) Raise the engine enough to remove the engine mount. It may be necessary to disconnect the engine damper.
(4) Remove the engine mount nut (Fig. 1)
(5) Remove the engine mount (Fig. 1).

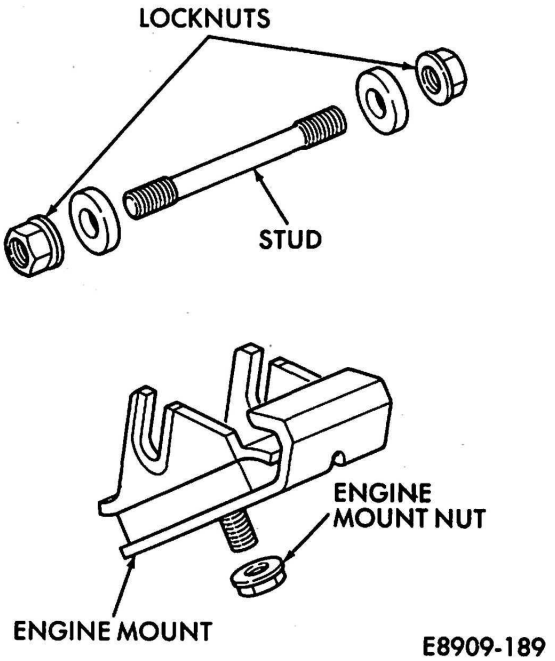


Fig. 1—Front Engine Mount

Installation

(1) Install the engine mount and nut. Do not tighten the nut at this time.
(2) Lower the engine in place on the engine mounts.
(3) Tighten the engine mount nut to 65 N·m (48 ft-lbs) torque.
(4) Tighten the stud locknuts to 65 N·m (48 ft-lbs) torque.
(5) Connect the battery negative cable.

REAR ENGINE MOUNT/CUSHION

Removal (ZF-4 Transaxle)

(1) Disconnect the battery negative cable.
(2) Support and raise the vehicle.
(3) Remove the underbody splash shield (Fig. 2).
(4) Support the transaxle with a jack stand (Fig. 3). Take care to avoid damaging the oil pan.

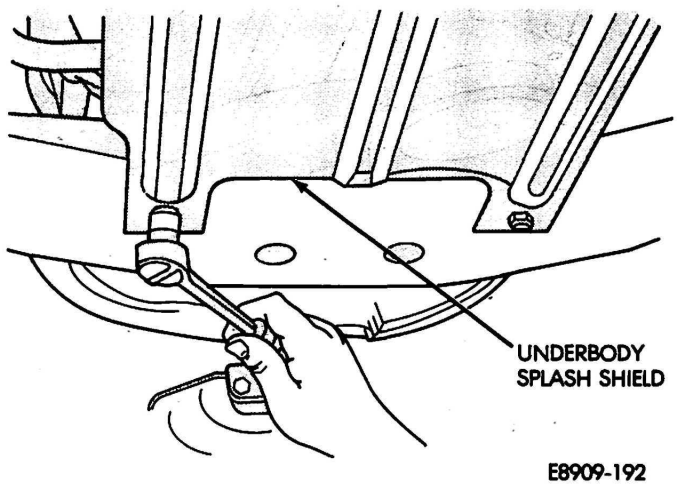


Fig. 2—Underbody Splash Shield

(5) Remove the nuts attaching the crossmember to the engine cradle (Fig. 4).

(6) Remove the large bolt and nut that attaches the rear cushion to the support bracket (Fig. 5).

(7) Remove the bolts that attach the exhaust downpipe bracket to the rear cushion and the downpipe (Fig. 5).

(8) Remove the crossmember and the rear cushion.

(9) Remove the support bracket bolts and remove the bracket from the transaxle (Fig. 6).

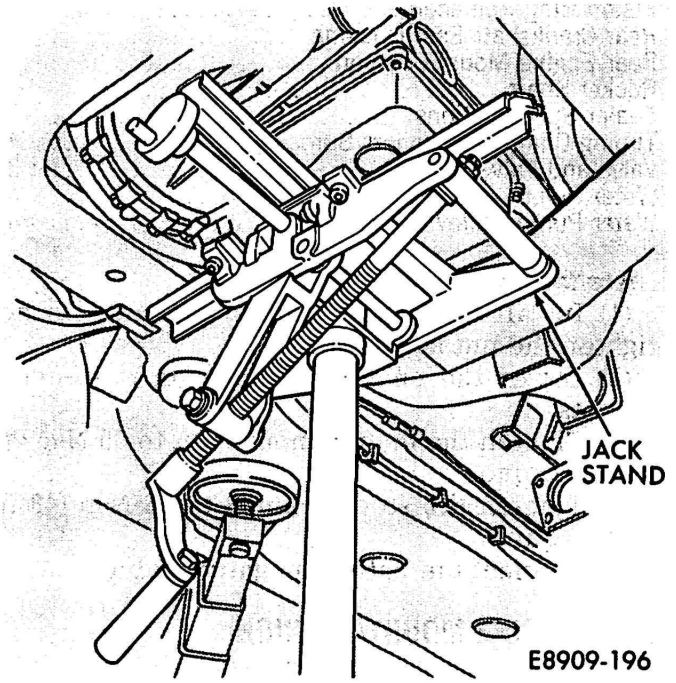


Fig 3—Jack Stand Supporting Transaxle

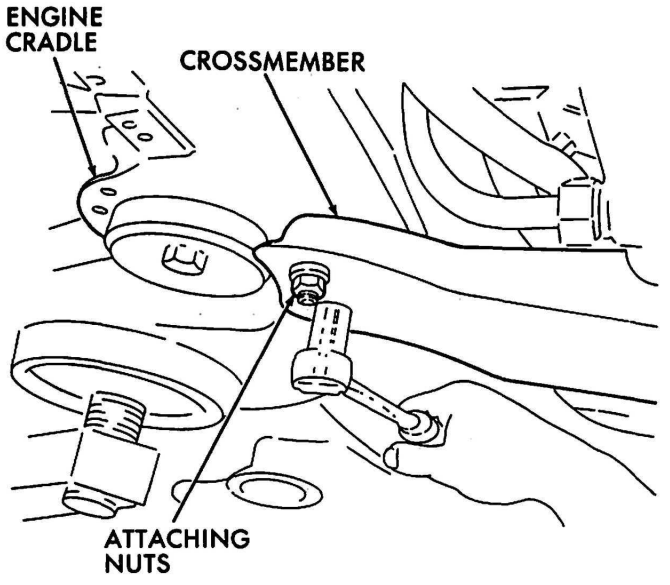


Fig. 4—Crossmember/Engine Cradle

Installation (ZF-4 Transaxle)

(1) Install the support bracket on the transaxle (Fig. 6). Tighten the support bracket bolts to 40 N·m (30 ft-lbs) torque.

(2) Position the exhaust bracket on the rear cushion (Fig. 5).

(3) Install the rear cushion and the crossmember. Align the cushion in the support bracket and install the cushion-to-bracket bolt and nut (Fig. 7) Do not tighten the bolt at this time.

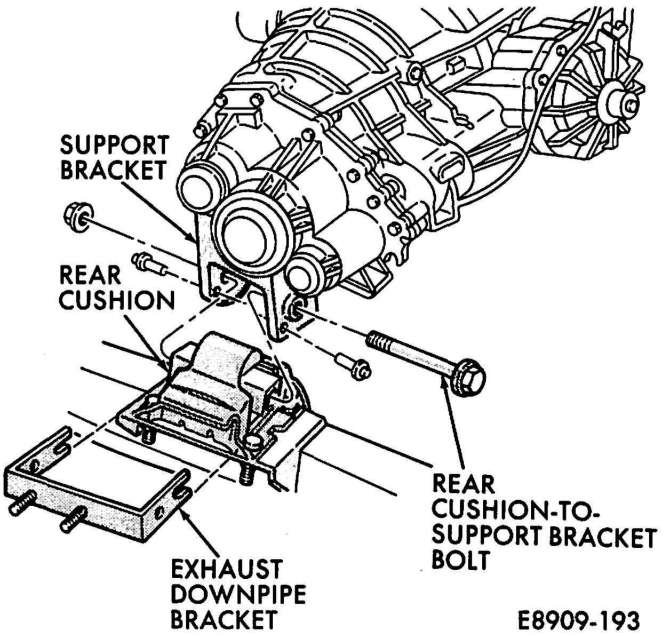


Fig. 5—Engine Rear Mount/Cushion

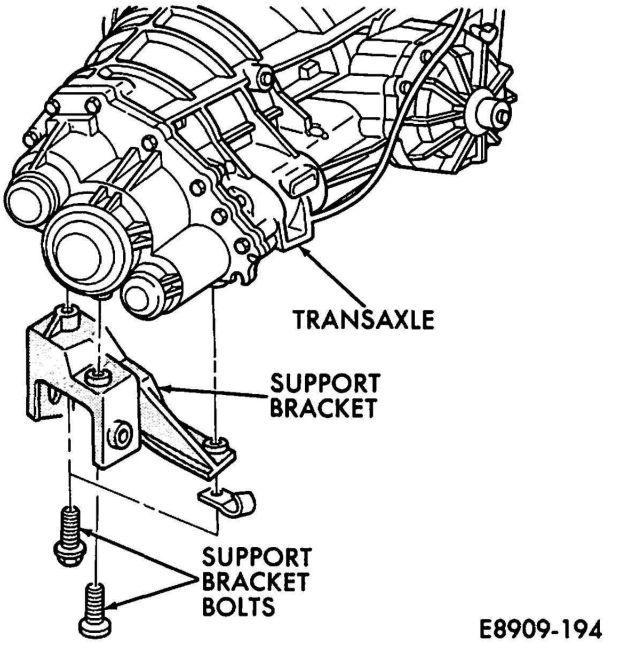


Fig. 6—Transaxle Support Bracket

(4) Install, but do not tighten the exhaust bracket bolts.

(5) Tighten the rear cushion-to-support bracket bolt and nut to 67 N·m (49 ft-lbs) torque.

(6) Tighten the bolts that attach the exhaust bracket to the rear cushion to 31 N·m (23 ft-lbs) torque (Fig. 8).

(7) Install the bolts and nuts that attach the crossmember to the studs on the engine cradle. Tighten the nuts to 60 N·m (44 ft-lbs) torque.

(8) Remove the jack stand from the transaxle.

(9) Install the underbody splash shield. Tighten the shield bolts to 28 N·m (21 ft-lbs) torque.

(10) Lower the vehicle.

(11) Connect the battery negative cable.

ENGINE DAMPER

Removal

(1) Remove the bolt and locknut from the damper mounting bracket (Fig. 9).

(2) Remove the bolt and nut from the front engine bracket (Fig. 9).

(3) Discard the engine damper, if damaged.

Installation

(1) Position the engine damper to the damper mounting bracket with the bottom damper bolt. Tighten the locknuts to 27 N·m (20 ft-lbs) torque.

(2) Install the engine damper to the front engine bracket with the top damper bolt. Tighten the nut to 43 N·M (32 ft-lbs) torque.

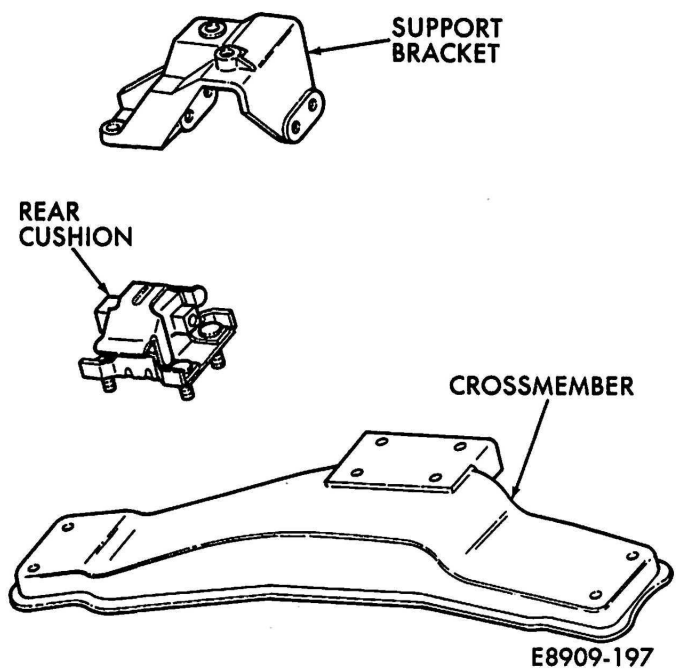


Fig. 7—Rear Cushion/Crossmember/Support Bracket Alignment

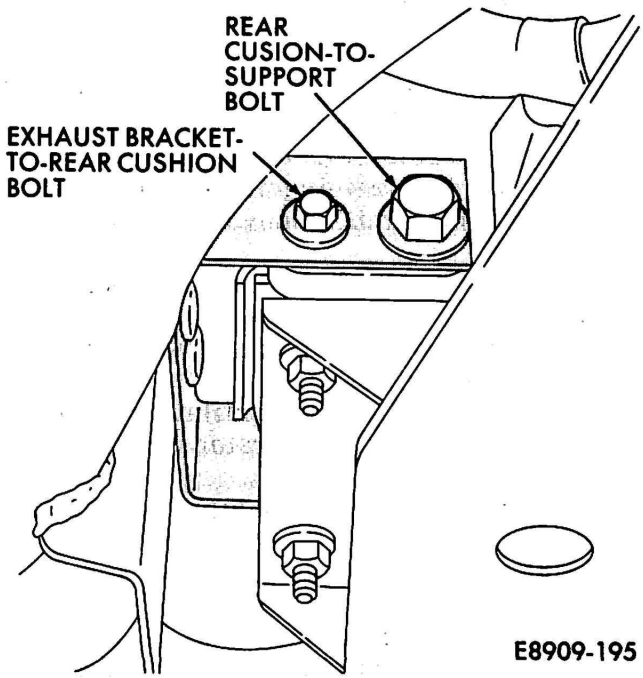


Fig. 8—Attach Exhaust Bracket to Rear Cushion

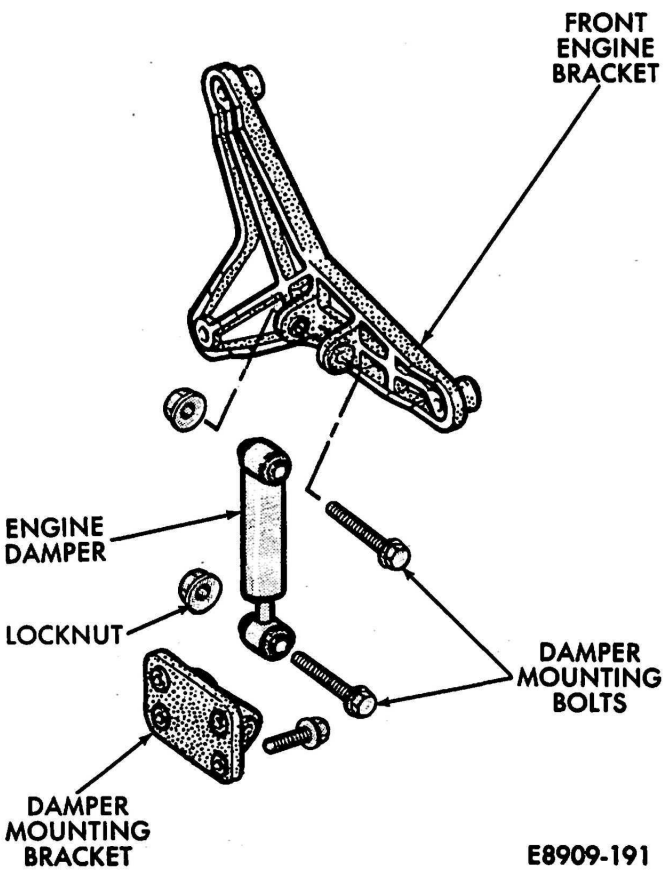


Fig. 9—Engine Damper

ENGINE/TRANSAXLE/CRADLE

Removal

(1) Disconnect the battery negative cable FIRST and then disconnect the battery positive cable.

(2) Drain the radiator (refer to Group 07, Cooling System, for the draining procedures).

(3) Remove the throttle body bonnet mounting bolts (Fig. 1).

(4) Remove the hose from the idle speed regulator (Fig. 1).

(5) Loosen the hose clamp and remove the throttle body bonnet (Fig. 1).

(6) Disconnect crankcase ventilation fresh air inlet hose and remove evaporator canister hose at air cleaner (Fig. 2).

(7) Remove air sensor vacuum hose at air cleaner (Fig. 2).

(8) Remove the distributor coil wire and lay it to the side.

CAUTION: When removing the cruise control cable from the throttle arm, use finger pressure to remove the connector. Use of pliers can damage the connector.

(9) Disconnect cruise control cable and accelerator cable from throttle arm (Fig. 3).

(10) Depress the holding tabs on the cruise control and accelerator cables and push them through the holding bracket. Then lay the cables to the side of the engine compartment.

(11) Disconnect hot air tube at the air cleaner (Fig. 4).

(12) Disconnect the air cleaner retainer clips.

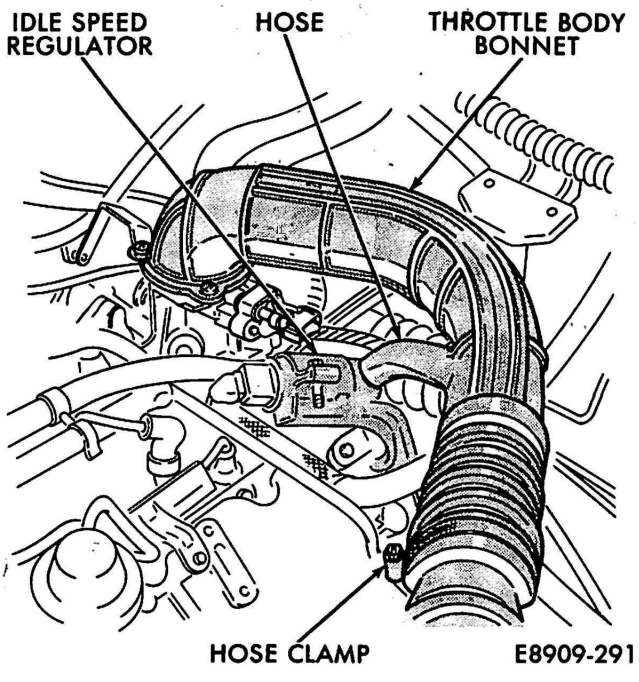


Fig. 1—Throttle Body Bonnet/Idle Speed Regulator

(13) Remove the air cleaner.

(14) Remove the battery holddown clamp. Then carefully remove the battery from the vehicle.

(15) Remove the fuel tank filler cap to relieve the fuel tank pressure.

(16) Install the fuel tank filler cap.

(17) Disconnect the grey fuel return tube from the fuel pressure regulator and the black fuel supply tube from the fuel rail (Fig. 5). Squeeze the retainer tabs and pull the connectors apart.

(18) Disconnect the vacuum hoses from the EGR Solenoid (Fig. 6).

(19) Disconnect the vacuum hose at the MAP sensor (Fig. 7).

(20) Disconnect Hevac Vacuum reservoir hose (Fig. 7).

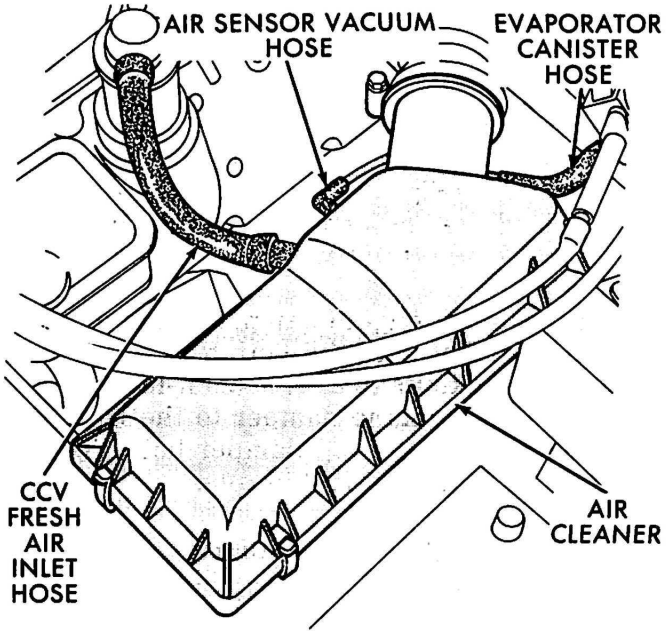


Fig. 2—CCV Hose/Evaporator Hose/Sensor Hose at Air Cleaner

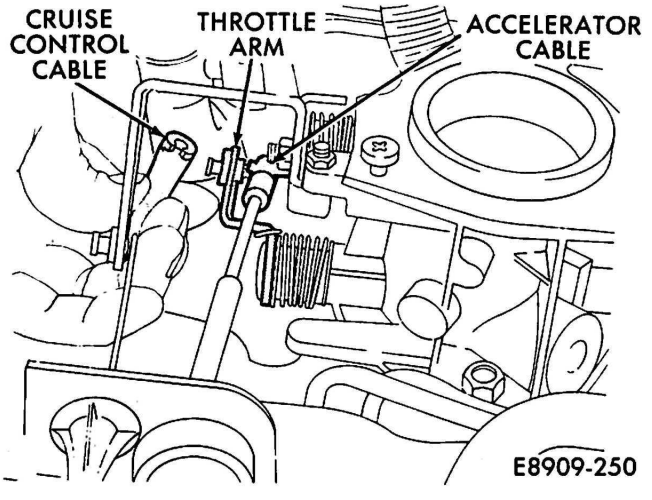


Fig. 3—Cruise Control/Accelerator Cable

(21) Loosen the bulkhead connector bolt and pull the bulkhead connector off (Fig. 7). Lay the bulkhead connector on top of the engine.

(22) Disconnect the vacuum booster hose from the brake vacuum booster (Fig. 8). Lay the hose on top of the engine.

(23) Disconnect the electrical connector at the dash panel (Fig. 8).

(24) Disconnect the heater hoses at the dash panel (Fig. 9).

(25) Disconnect the bottom hose from the coolant pressure bottle (Fig. 9).

(26) Disconnect the radiator hoses from the water pump and stow hoses to the side.

(27) Disconnect the engine damper from engine bracket. Push the shock up against the cooling fan (Fig. 10).

(28) Open the door on the drivers side and remove the bottom instrument panel section under the steering wheel.

(29) Disconnect the shifter cable from the arm on steering column (Fig. 11).

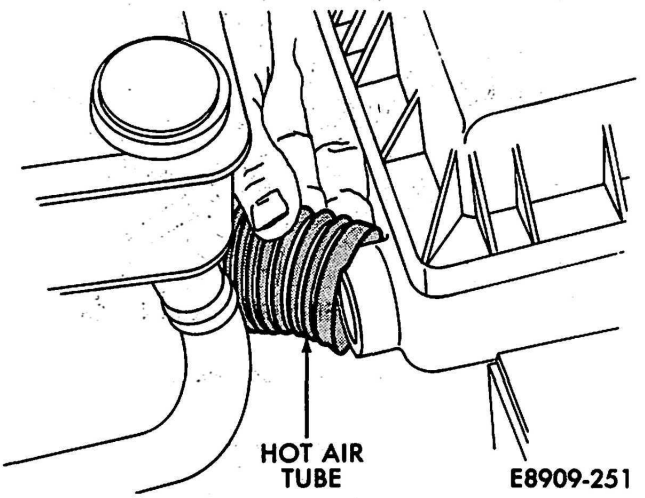


Fig. 4—Hot Air Tube at Air Cleaner

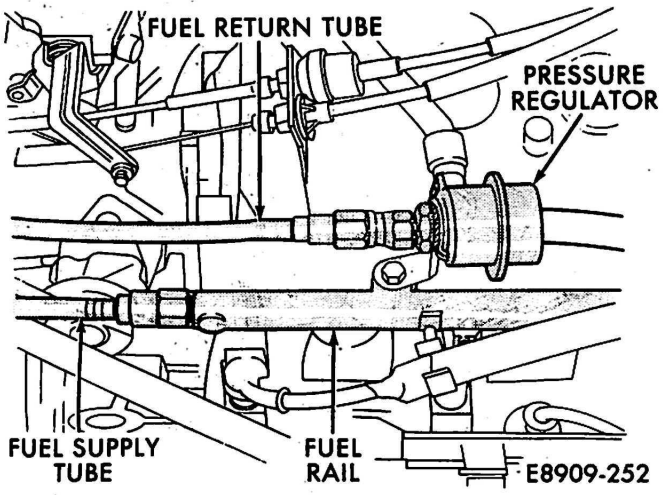


Fig. 5—Fuel Tubes/Regulator/Fuel Rail

(30) Depress the tabs on the side cable housing and pull the cable through the holding bracket.

CAUTION: The vehicle must be raised on a side mount hoist. Do not support the vehicle by the lower control arms. Lift the vehicle only at the points shown in Fig. 12.

(31) Raise the vehicle.

(32) Remove the splash shield below the alternator.

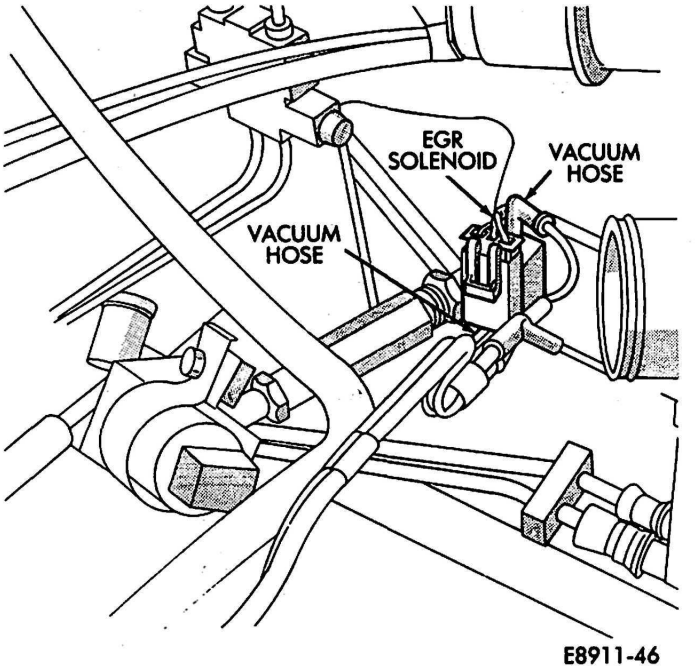


Fig. 6—EGR Solenoid and Vacuum Hoses

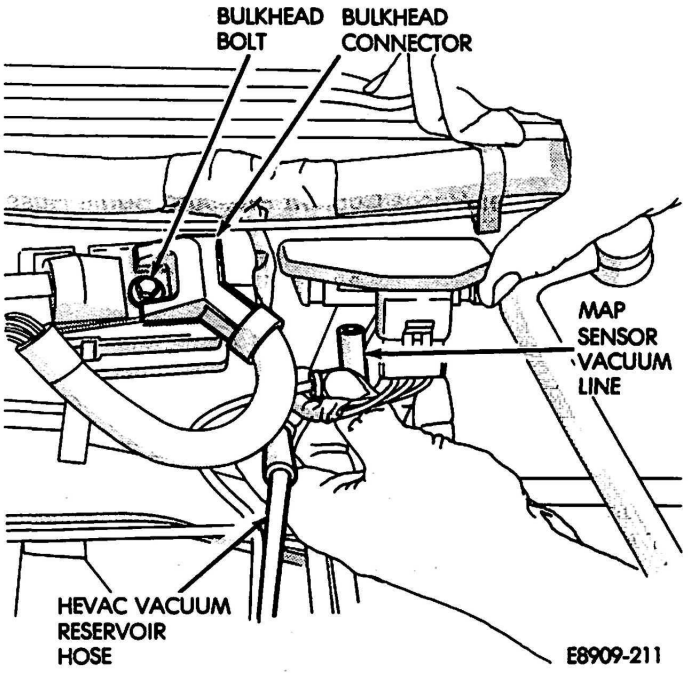


Fig. 7—MAP Line/Hevac Hose/Bulkhead Connector

(33) Disconnect the knock sensor connector, the oil level sensor connector, the oil pressure sender connector and the alternator connector (Fig. 13).

(34) Disconnect the alternator output wire from the back of the alternator (Fig. 13).

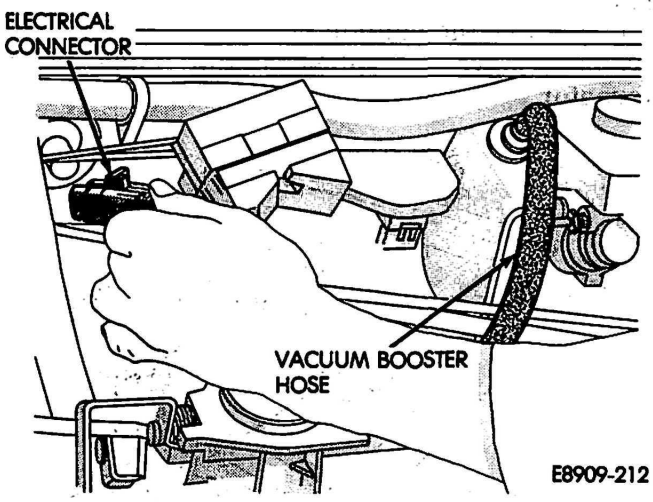


Fig. 8—Electrical Connector/Vacuum Booster Hose

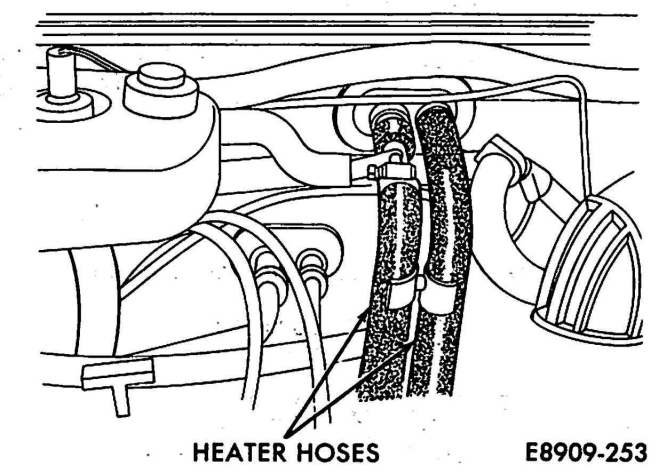


Fig. 9—Heater Hoses/Coolant Pressure Bottle Hose

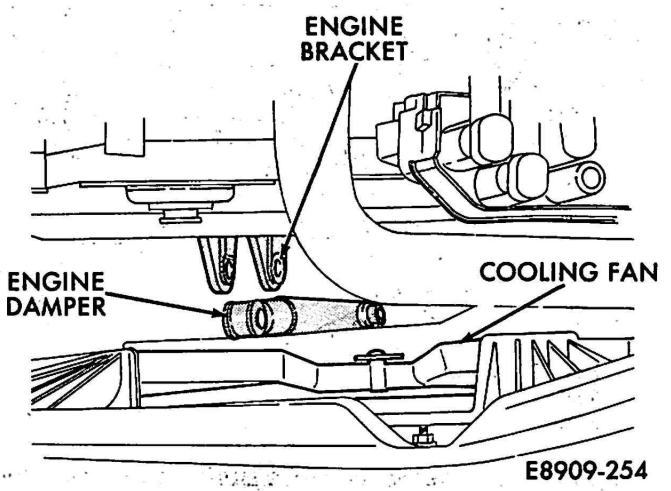


Fig. 10—Engine Damper

(35) Disconnect the wire harness clip from the back of the alternator (Fig. 13). Stow the wire harness to the side of the engine compartment.

(36) To loosen the accessory drive belt, loosen the pivot bolt, the locking bolt and the adjusting bolt (Fig. 13).

(37) Loosen the power steering pump nuts, and bolts until front bracket drops down (Fig. 14).

(38) Remove the stud bolt behind the front power steering bracket.

(39) Remove the rear power steering pump bracket mounting bolts.

(40) Remove the power steering pump from the engine and temporarily stow it with mechanics wire.

(41) Remove the power steering reservoir mounting bolts.

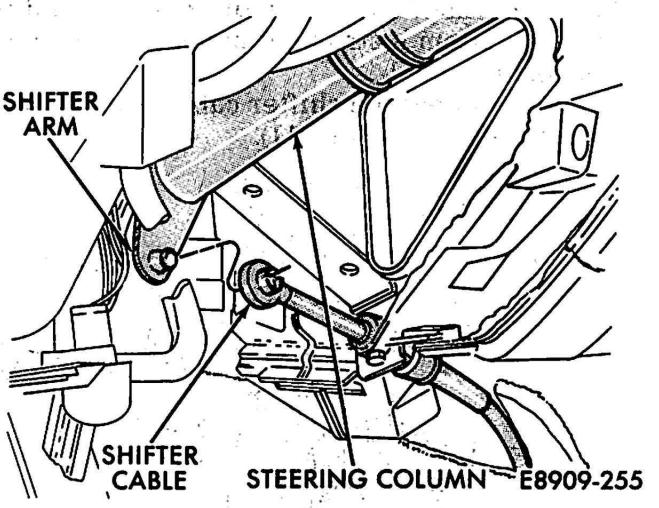


Fig. 11—Shifter Cable

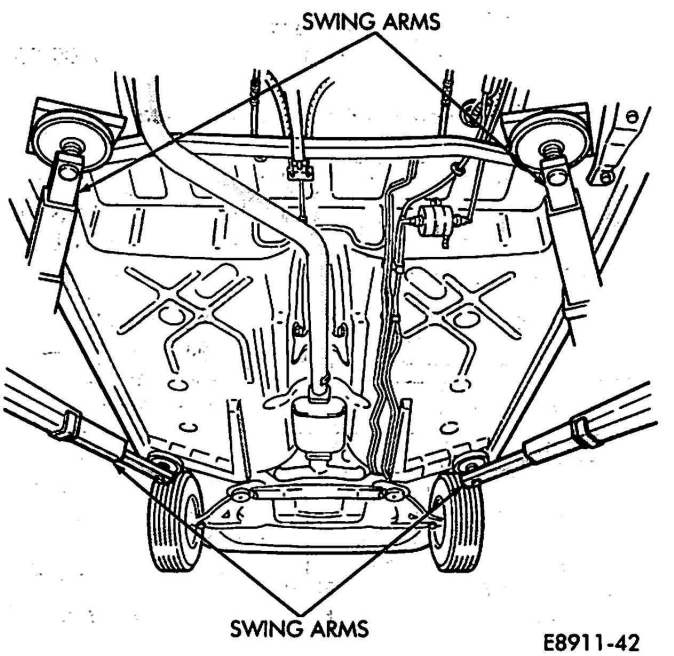


Fig. 12—Side Mounted Swing Arm Hoist

(42) Stow the power steering pump and reservoir in the drivers side of the engine compartment.
(43) Lower the vehicle.
(44) If equipped, remove the air conditioning compressor mounting bolts (Fig. 15). Remove the A/C compressor and stow it in the passengers side of the engine compartment.
(45) Raise the vehicle halfway.
(46) Remove the front tires.
CAUTION: Do not remove the hydraulic brake lines and do not let caliper hang by the hydraulic hose.
(47) Remove the brake calipers and disc pads (refer to Group 5, "Brakes" for the proper procedure).
(48) Use mechanics wire to hang the calipers in the strut springs (Fig. 16).

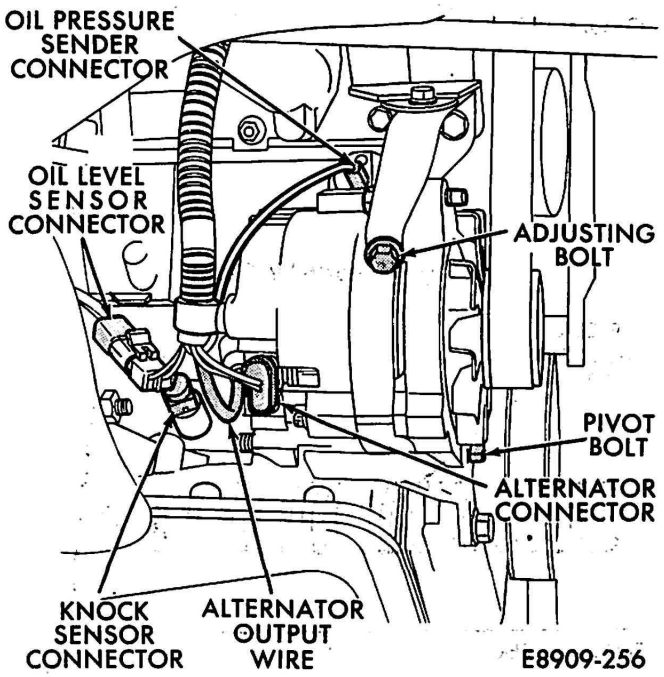


Fig. 13—Alternator Bolt and Sensor Locations

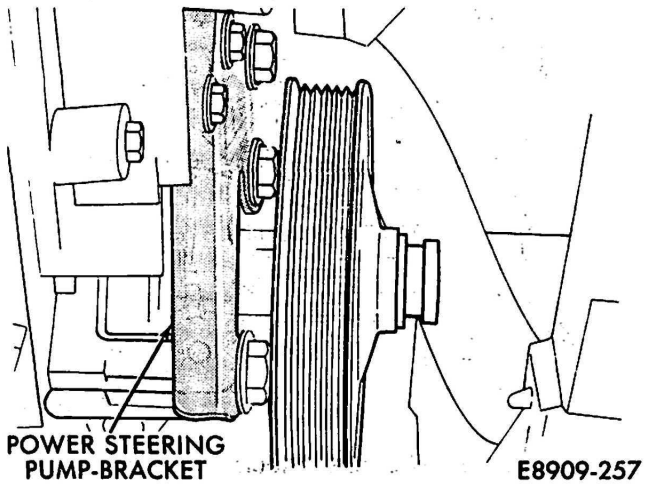


Fig. 14—Power Steering Pump Bracket

(49) Hold the hub in place and loosen the hub nut on both sides.
CAUTION: The steering knuckle bolts are splined into the knuckle. Do not turn the bolts to loosen, instead loosen the nuts.
(50) Remove the steering knuckle to strut attaching bolt nuts on both sides of the vehicle.
CAUTION: Use a brass hammer to tap the steering knuckle bolts out. Do not use a steel hammer as damage to the threads will occur.
(51) On both sides of the vehicle tap the top steering knuckle bolt out first. Pull the strut out, pivoting the steering knuckle on the lower bolt.
(52) Tap the lower steering knuckle bolt out and separate the steering knuckle from the strut (Fig. 17).
(53) Raise the vehicle all the way up.
(54) Disconnect the battery negative cable and solenoid wire at the starter.
(55) Remove the middle starter mounting bolt and disconnect the ground cable.

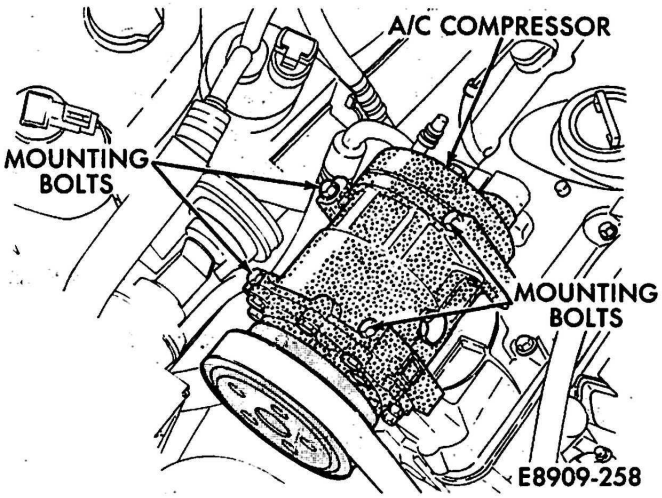


Fig. 15—A/C Compressor Bolts

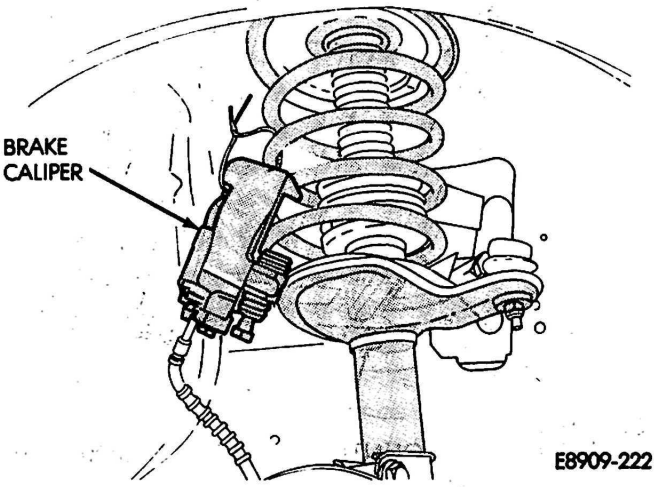


Fig. 16—Hang Brake Caliper

(56) Remove the front sill shield by unscrewing the mounting bolts (Fig. 18).

(57) Disconnect oxygen (O_2) sensor connector at Y-pipe.

(58) Pull the grommet surrounding the shifter cable down (Fig. 19).

(59) Grasp the shifter cable and pull it through the hole in the body (Fig. 19).

(60) Disconnect the catalytic converter from the Y-pipe.

(61) Install special attaching bolts into the cradle by pushing the large end of the channel iron into the hole in the cradle (Fig. 20).

(62) Jiggle the bolt until the channel iron lays flat in the hole. Do the same with the other bolt.

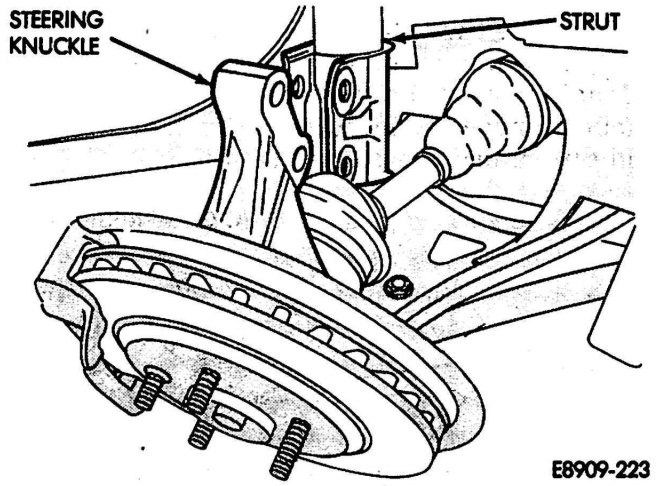


Fig. 17—Steering Knuckle/Strut

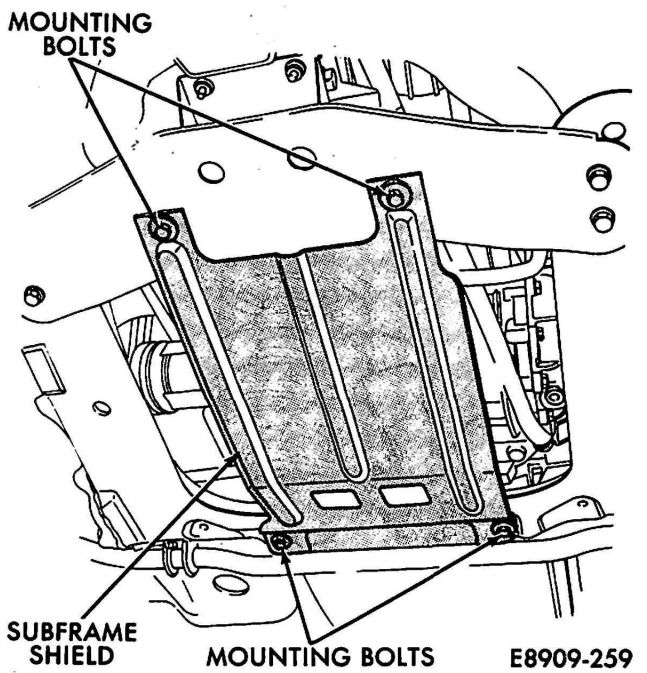


Fig. 18—Front Sill Shield

(63) Install the dolly to the cradle with the dolly wheels towards the rear of the vehicle. Tighten the nuts.

(64) Lower the hoist until the dolly rests on the floor.

(65) Laying on a mechanics creeper or on the floor, remove the four cradle mounting bolts (Fig. 21).

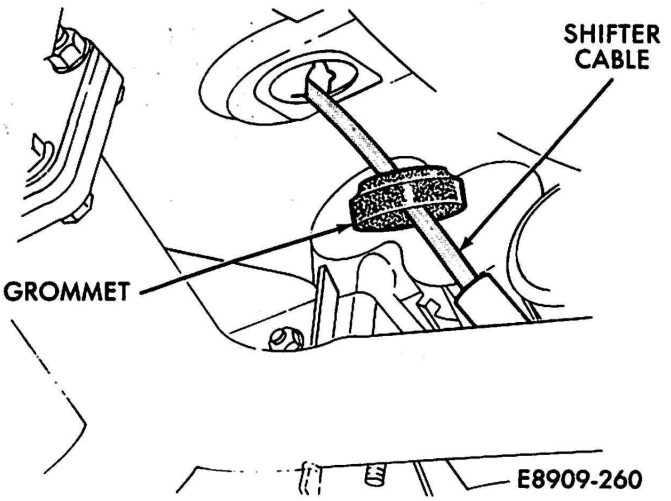


Fig. 19—Shifter Cable

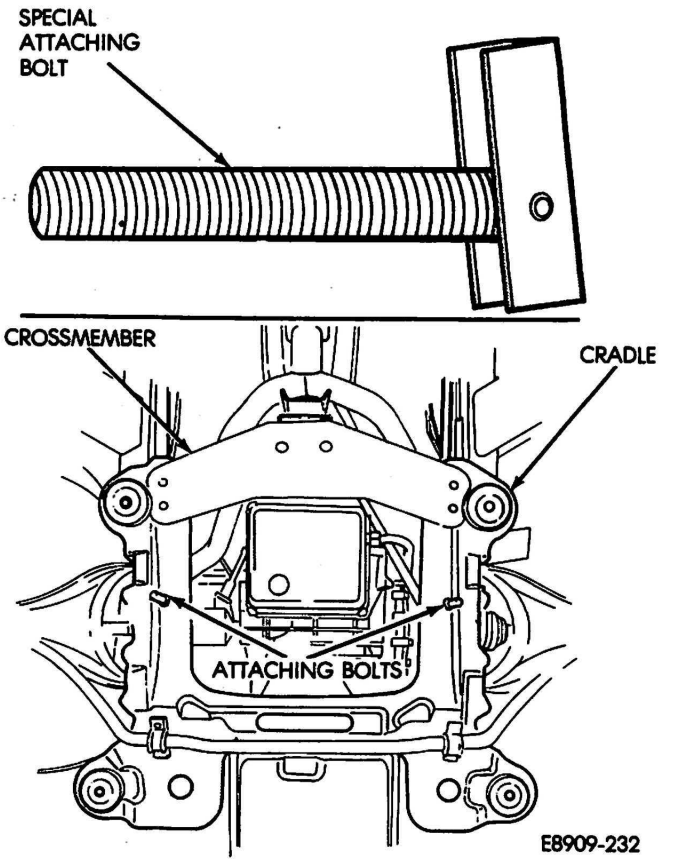


Fig. 20—Special Attaching Bolts

CAUTION: Ensure all hoses, vacuum lines and wire harnesses are positioned so that they will not snag and catch when the vehicle is lifted off the engine.

(66) Slowly raise the vehicle off the engine.

(67) Draw the outline of the dolly legs and the center line of the wheels on the floor. Once the dolly is repositioned under the vehicle, it can be correctly positioned so that it aligns with the vehicle at installation.

(68) To move the dolly, position a floor jack under the center of the front bar of the dolly. Jack up the dolly until the front legs are approximately one inch off the floor. Push the dolly/floor jack to the desired position.

Engine Removal from Transaxle

(1) Support the transaxle with brackets supplied with cradle dolly.

(2) Attach an overhead crane of engine lift to the lift brackets on the cylinder heads.

(3) Loosen the engine mount to cradle stud nuts.

(4) Remove the starter motor.

(5) Remove the access cover bolt (Fig. 22).

(6) Remove torque converter bolts one at a time (Fig. 22). Rotate engine until all bolts are removed.

(7) Remove transaxle road speed sensor (Fig. 22).

(8) Disconnect transaxle oil cooler hoses (Fig. 23).

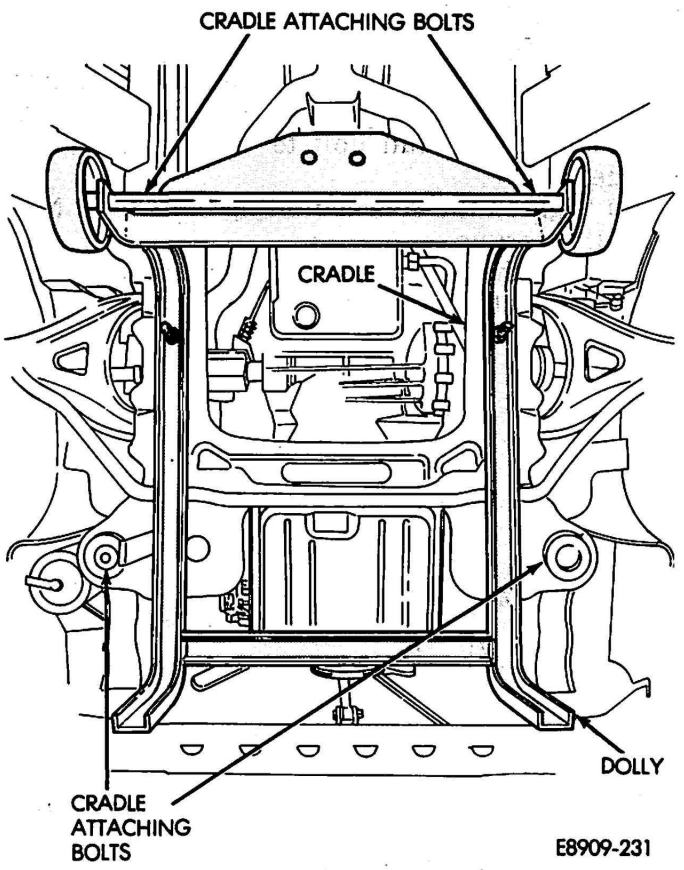


Fig. 21—Dolly Attached to Cradle

(9) Disconnect the transmission kick-down cable at the throttle body (refer to Group 21, Transaxle, for the proper procedure).

(10) Remove the top transaxle mounting bolts (Fig. 24) and the lower nuts from the aligning studs (Fig. 23).

(11) Remove the engine from the transaxle.

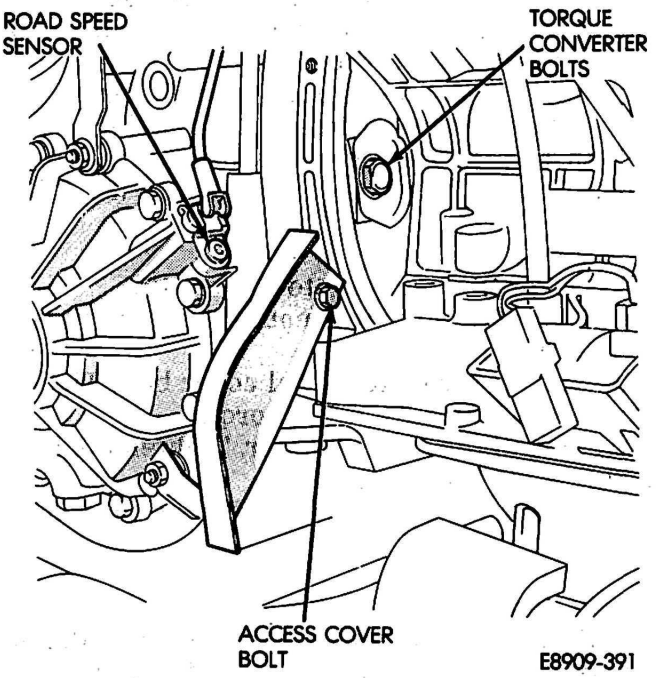


Fig. 22—Access Cover/Torque Converter/Road Speed Sensor

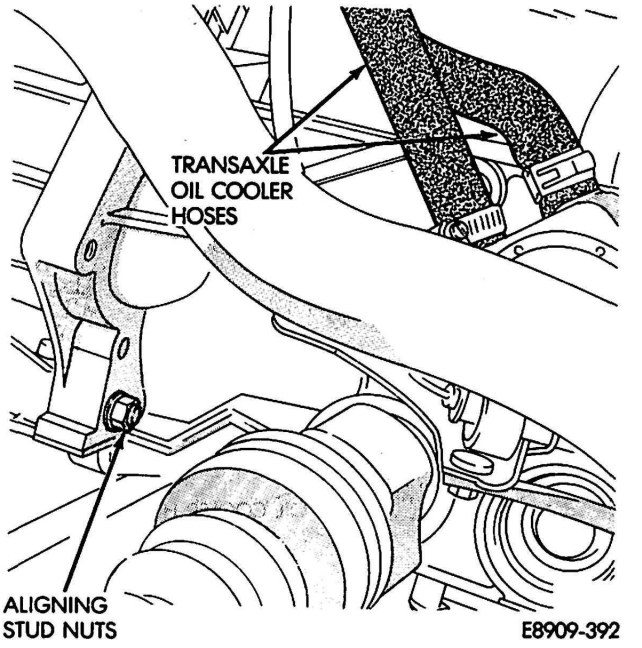


Fig. 23—Oil Cooler Hoses/Aligning Stud Nuts

Engine Installation to Transaxle

(1) Prior to connecting the engine to the transaxle, ensure that the torque converter is pushed back completely into the pump.

(2) Install the top transaxle mounting bolts and alignment stud nuts. Tighten the bolts and nuts to 65 N·m (48 ft-lbs) torque.

(3) Install the transaxle road speed sensor.

(4) Install and adjust the transmission kickdown cable at the throttle body (refer to Group 21, Transaxle, for the proper procedure).

(5) Connect the transmission oil cooler hoses.

(6) Install the torque converter to drive plate bolts. Tighten these bolts to 33 N·m (24 ft-lbs) torque.

(7) Install the access cover.

(8) Lower the engine into the cradle.

(9) Tighten the engine mount stud and nuts to 40 N·m (30 ft-lbs) torque.

(10) Install the differential cover bolt. Tighten the bolt to 27 N·m (20 ft-lbs) torque.

(11) Install the starter motor. Tighten the bolts to 42 N·m (31 ft-lbs) torque.

(12) Disconnect the engine lift or over head crane.

Installation

(1) Position the engine/transmission/cradle assembly under the vehicle. Align the dolly with the outline of the dolly legs and wheels drawn on the floor when the assembly was removed.

CAUTION: Ensure all hoses, vacuum lines and wire harnesses are positioned so that they will not snag and catch when the vehicle is lowered onto the cradle.

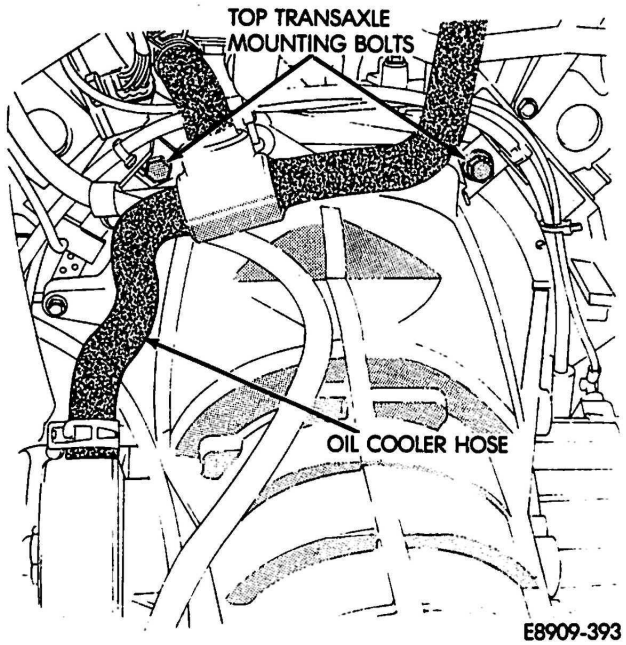


Fig. 24—Top Transaxle Mounting Bolts

(2) Lower the vehicle onto the cradle. Stop when the vehicle just touches the cradle bolt pads.

(3) Install cradle mounting bolts (Fig. 25). The cradle bolt has a rubber spacer and metal washer. They must be installed with the rubber spacer between the body and the washer. Tighten the bolts to 125 N·m (92 ft-lbs) torque.

(4) Raise the vehicle halfway.

(5) Push the lower control arm down and reconnect the steering knuckle to the strut. Install the top bolt first. Then the lower bolt. The strut bolts are splined to the steering knuckles. Tighten the nuts, not the bolts. Tighten the nuts to 167 N·m (123 ft-lbs) torque.

(6) Install the disk brake pads and calipers (refer to Group 5, Brakes, for the proper procedure).

(7) Hold the hub in place and tighten the hub nuts to 245 N·m (181 ft-lbs) torque.

(8) Raise the vehicle the rest of the way up.

(9) Remove the dolly from the cradle. Remove the special bolts from the cradle.

(10) Connect the catalytic converter to the Y-pipe.

(11) Connect the electrical connector to the oxygen (O_2) sensor.

(12) Connect the starter wires and the battery negative wire.

(13) Position the power steering pump against the engine. Finger tighten the rear bracket mounting bolts (Fig. 26).

(14) Install the stud bolt through the timing cover and thread it into the rear bracket (Fig. 27). Tighten the stud bolt to 40 N·m (30 ft-lbs) torque.

(15) Tighten the rear mounting bolts to 27 N·m (20 ft-lbs) torque.

(16) Pivot the power steering pump front bracket up over the stud bolt (Fig. 27).

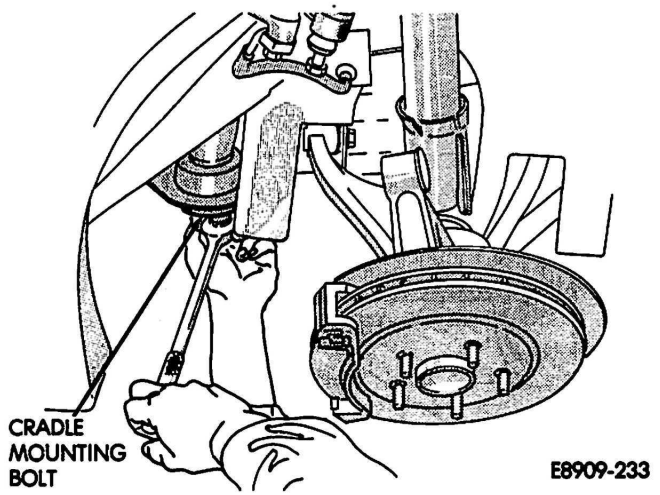


Fig. 25—Cradle Mounting Bolts

(17) Thread the lower front mounting bolt in a couple of threads.

(18) Start the nut on the stud. Finish tightening the lower front mounting bolt to 40 N·m (30 ft-lbs) torque.

(19) Tighten the stud nut to 40 N·m (30 ft-lbs) torque.

(20) Install the upper front mounting bolt. (Fig. 28). Tighten the bolt to 27 N·m (20 ft-lbs) torque.

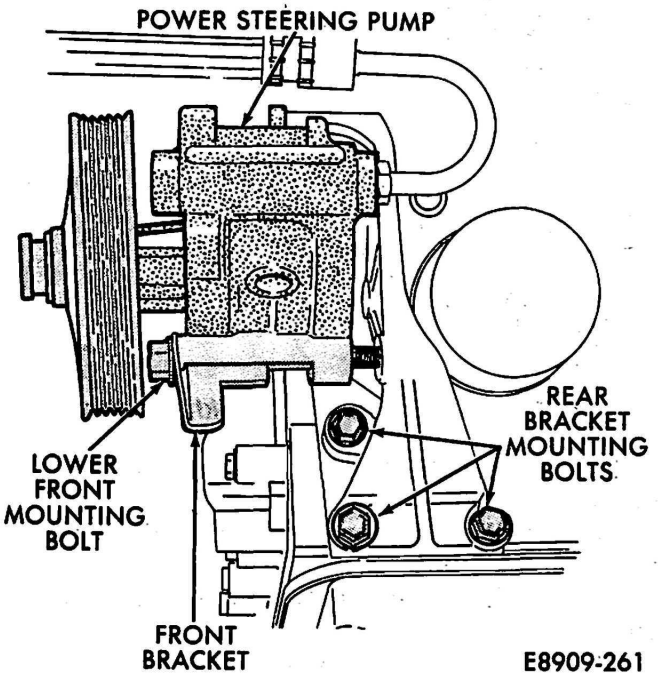


Fig. 26—Power Steering Pump

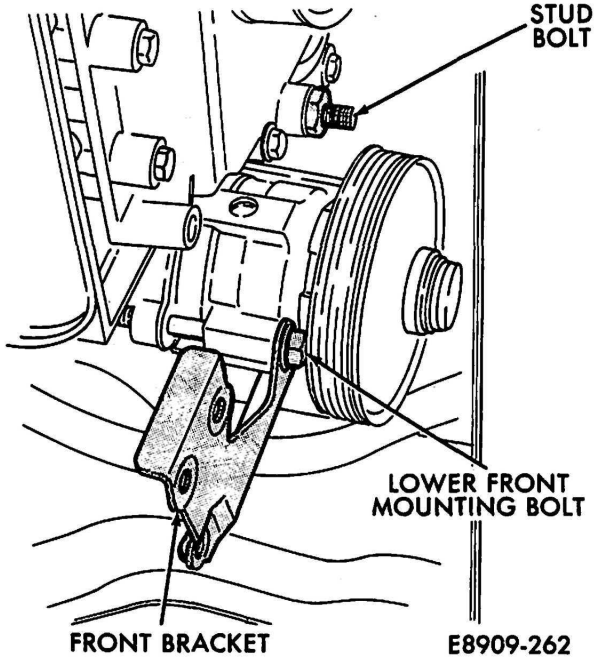


Fig. 27—Power Steering Pump Front Bracket

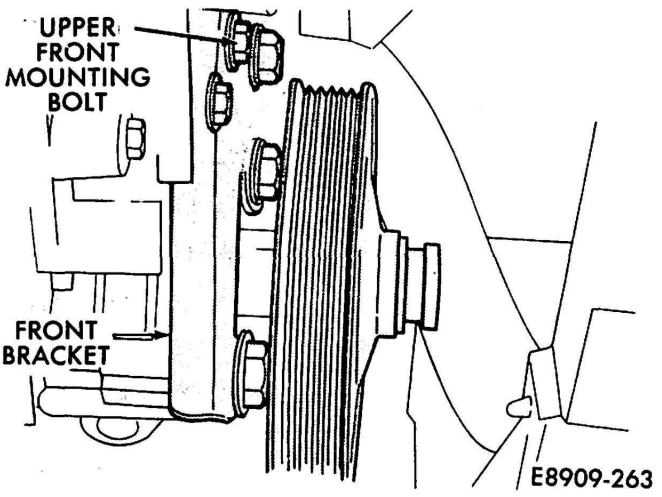


Fig. 28—Upper Front Mounting Bracket Bolt

(21) Connect the alternator output wire, the alternator connector and the wire harness clip at the alternator.

(22) Connect the oil pressure sender wire to the sender.

(23) Connect the oil level sensor electrical connectors.

(24) Connect the knock sensor electrical connector to the knock sensor.

(25) Position the splash shields in the wheel wells so that they hang straight down.

(26) Install both front tires and wheels. Tighten the lug nuts to 85 N·m (63 ft-lbs) torque.

(27) Push the transmission shifter cable through the hole in the body and into the passengers compartment. Position the grommet in the hole.

(28) Lower the vehicle.

(29) Install the air conditioning compressor on the valve cover. Tighten the bolts to 27 N·m (20 ft-lbs) torque.

(30) Position the accessory drive belt on the pulleys. Be sure that the belt is routed correctly (refer to Group 7, Cooling System, Drive Belt Adjustments, for the proper procedure).

(31) Raise the vehicle.

(32) Install a belt tension gauge on the accessory drive belt halfway between the air conditioning compressor and the alternator. On vehicles without air conditioning, install the gauge halfway between the water pump and the alternator.

(33) Tighten the adjusting bolt until the correct belt tension is obtained (Fig. 29). If a new accessory drive belt is installed, it must be tensioned after 12 070 km (7500 miles) of usage. Correct belt tension is:

- New Belt—180-200 lbs.
- Used Belt—140-160 lbs.

(34) Tighten the alternator pivot bolt to 50 N·m (37 ft-lbs) torque.

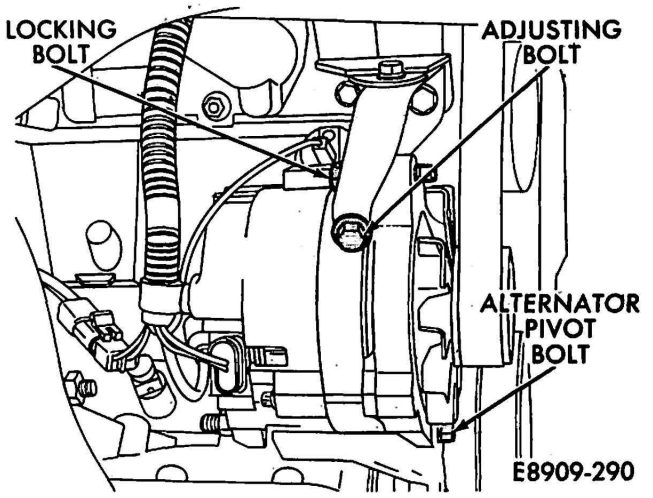


Fig. 29—Belt Tensioning

(35) Tighten the alternator locking bolt to 27 N·m (20 ft-lbs) torque.

(36) Install the splash shield under the alternator.

(37) Lower the vehicle.

(38) Connect the heater hoses at the dash panel.

(39) Connect the coolant bottle lower hose.

(40) Push the black fuel supply tube onto the fuel rail until a audible click is heard (Fig. 30). Pull back to ensure that the connector is locked in place.

(41) Push the grey fuel return tube onto fuel pressure regulator until an audible click is heard. Pull back to ensure that the connector is locked in place.

(42) Connect the MAP sensor vacuum hose and the Hevac vacuum reservoir hoses (Fig. 31).

(43) Connect the bulkhead connector and secure with the bulkhead bolts (Fig. 31). Connect the electrical connector at the dash panel.

(44) Connect the EGR solenoid vacuum hoses (Fig. 32).

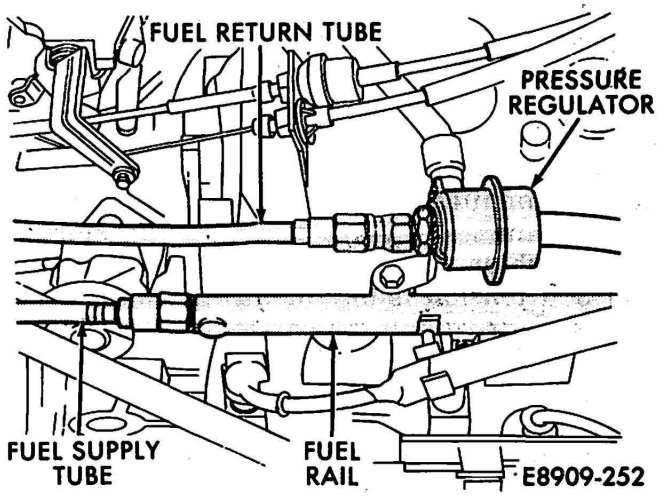


Fig. 30—Fuel Tubes/Regulator/Fuel Rail

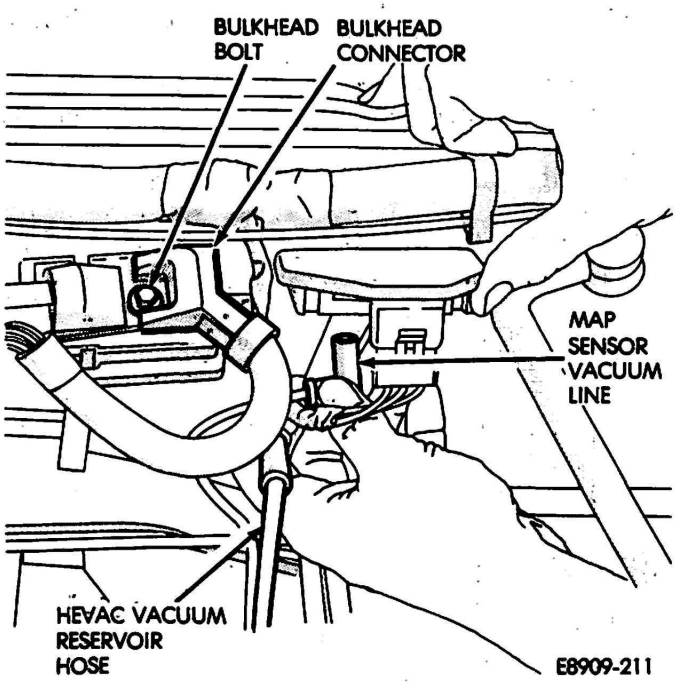


Fig. 31—MAP Line/Hevac Hose/Bulkhead Connector

(45) Connect the front engine shock absorber to the engine bracket.

(46) Install the upper and lower radiator hoses at the water pump.

(47) Install the power steering reservoir to the engine.

(48) Install the battery and battery holddown bracket.

(49) Install the air cleaner.

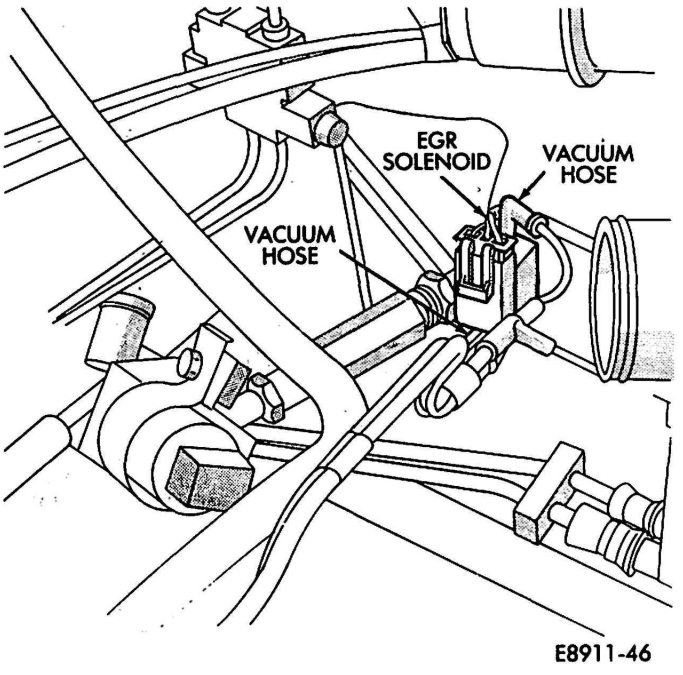


Fig. 32—EGR Solenoid and Vacuum Hoses

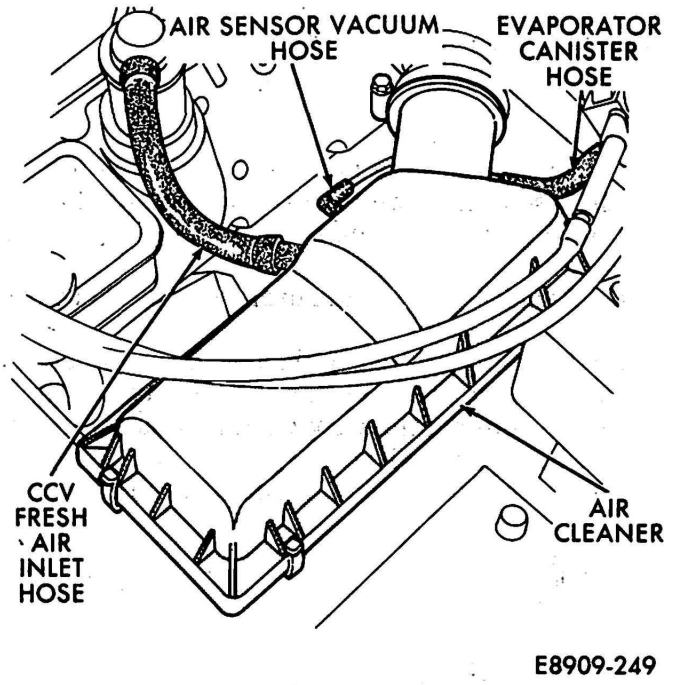


Fig. 33—CCV Hose/Evaporator Hose/Sensor Hose at Air Cleaner

(50) Install the air sensor vacuum hose at the air cleaner (Fig. 33).

(51) Route the coil wire through the clips on the air cleaner and install at the distributor cap.

(52) Connect the evaporator canister hose and the crankcase ventilation fresh air inlet hose at the air cleaner (Fig. 33).

(53) Connect the hot air tube to the air cleaner (Fig. 34).

(54) Connect the accelerator cable and cruise control cable to the throttle arm.

(55) Close the radiator drain.

(56) Connect the vacuum booster hose to the brake vacuum booster.

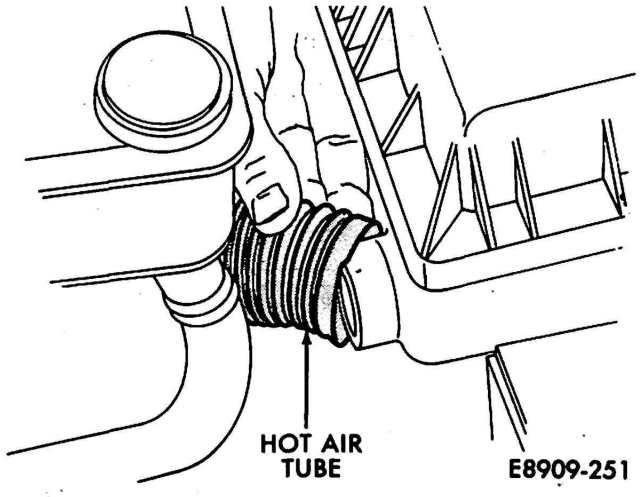


Fig. 34—Hot Air Tube at Air Cleaner

(57) Connect the transmission shifter cable. Slide it through the holding bracket and attach it to the arm on the steering column. Install the section of instrument panel.

(58) Install the throttle body bonnet.

(59) If the engine oil was drained, refill the crankcase with clean oil.

(60) Connect the battery positive cable first, then connect the battery negative cable.

(61) Fill the cooling system and bleed it (refer to Group 7, Cooling System, for the proper procedure).

ENGINE COVER

The engine intake manifold is covered by an engine cover which is attached to the fuel rail.

Removal

(1) Remove the mounting bolts (Fig. 1).

(2) Remove the engine cover.

Installation

(1) Install the engine cover over the fuel rails.

(2) Tighten mounting bolts.

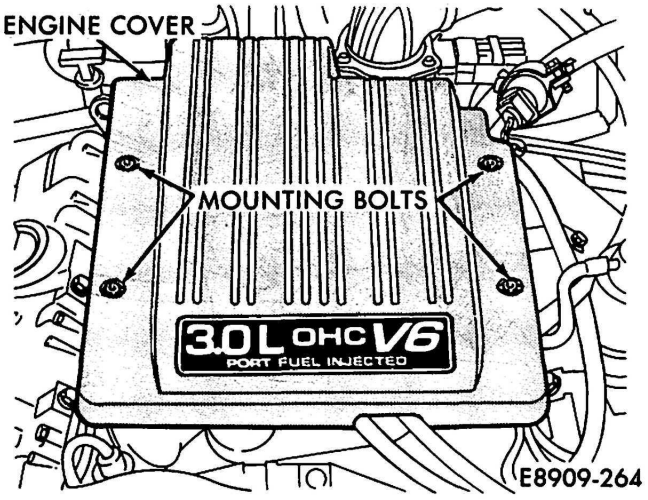


Fig. 1—Engine Cover

CYLINDER HEAD COVER—(ENGINE INSTALLED)

This procedure should be used with the engine installed in the vehicle.

Removal—Right Side

(1) Disconnect the battery negative cable.

(2) Loosen the accessory drive belt (refer to Group 7, Cooking System, Drive Belt Adjustments, for the proper procedure).

(3) Remove the spark plug wire holder.

(4) Remove the air conditioning compressor mounting bolts. Carefully position the air condi-

tioning compressor in the right side fender well and secure in place (Fig. 2).

(5) Loosen the cylinder head cover mounting bolts (Fig. 3).

(6) Remove the cylinder head cover and the old gasket (Fig. 3).

Installation—Right Side

(1) Clean the cylinder head and cylinder head cover mating surfaces.

(2) Apply a light coating of Jeep Gasket-in-a-Tube Sealer, or equivalent, to the top of the timing case cover to cylinder head joint areas.

(3) Install the cylinder head cover using a new gasket.

(4) Install the spark plug holder.

(5) Tighten the cylinder head cover bolts to 12 N·m (9 ft-lbs) torque.

(6) Install the air conditioning compressor. Tighten the mounting bolts to 27 N·m (20 ft-lbs) torque.

(7) Install the accessory drive belt (refer to Group 7, Cooling System, Drive Belt Adjustments, for the proper procedure).

(8) Connect the battery negative cable.

Removal—Left Side

(1) Disconnect the battery negative cable.

(2) Disconnect the throttle body bonnet/air inlet hose assembly from the throttle body and air cleaner.

(3) Remove the vacuum brake booster hose from the throttle body.

(4) Disconnect the crankcase ventilation (CCV) fresh air hose at the cylinder head cover (Fig. 4).

(5) Disconnect the CCV vacuum hose at the cylinder head cover (Fig. 4).

(6) Disconnect the air cleaner and remove it.

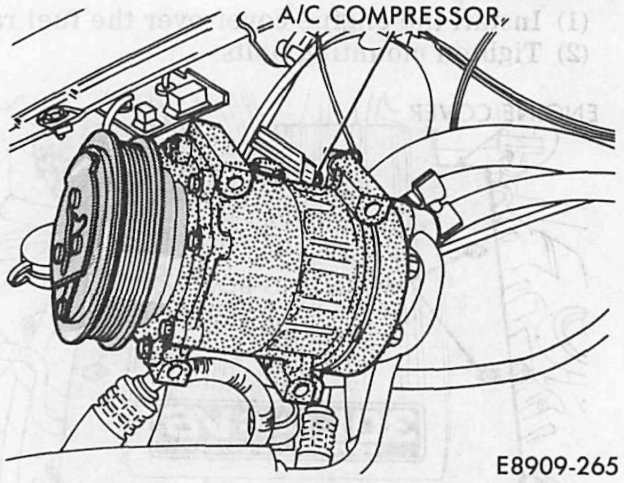


Fig. 2—A/C Compressor

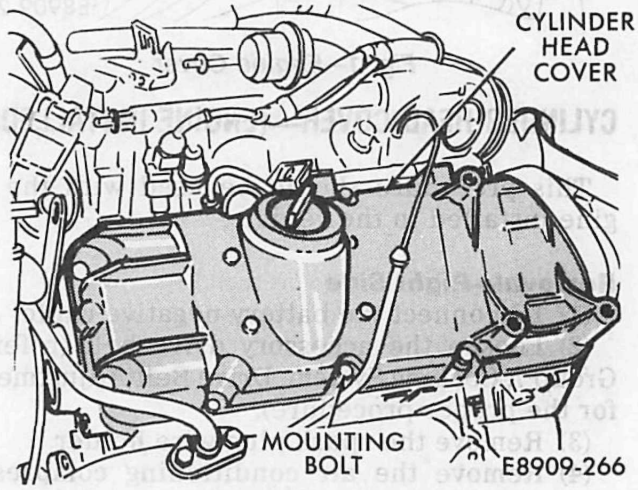


Fig. 3—Cylinder Head Cover

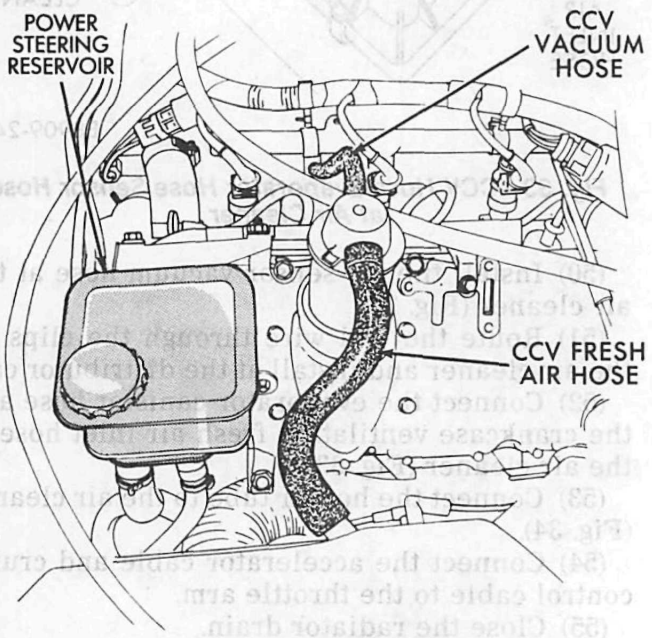


Fig. 4—CCV Hoses/Coolant Pressure Bottle

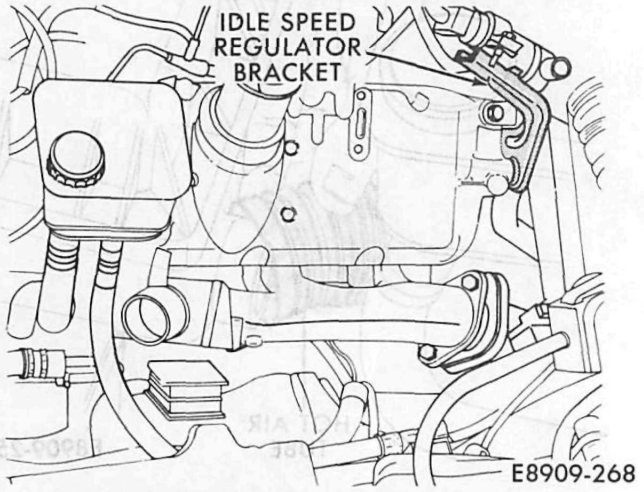


Fig. 5—Idle Speed Regulator Bracket

(7) Remove the power steering reservoir mounting bolts. Set the coolant pressure bottle (Fig. 4) in the air cleaner position.

(8) Disconnect the accelerator cable at the throttle body and hold down bracket. Lay to the side.

CAUTION: When disconnecting the cruise control cable at the throttle body, do not use pliers to remove the connector. Use finger pressure only. Pliers can break the connector.

(9) Remove idle speed regulator bracket mounting bolts at the rear of the valve cover (Fig. 5).

(10) Remove the spark plug wire holder.

(11) Loosen the cylinder head cover mounting bolts.

(12) Remove the cover and gasket.

Installation—Left Side

(1) Clean the cylinder head and cylinder head cover mating surfaces.

(2) Apply a light coating of Jeep Gasket-in-a-Tube Sealer, or equivalent, to the top of the timing case cover to cylinder head joint areas.

(3) Install the cylinder head cover and new gasket.

(4) Tighten the cylinder head cover mounting bolts to 12 N·m (9 ft-lbs)torque.

(5) Install the spark plug wire holder.

(6) Install the idle speed regulator bracket to the rear of the cylinder head cover.

(7) Connect the accelerator cable and cruise control cable to the holddown bracket and throttle body.

(8) Install the power steering pump reservoir.

(9) Install the air cleaner.

(10) Install CCV fresh air hose and vacuum hose.

(11) Connect vacuum brake booster hose.

(12) Connect the throttle body bonnet/air inlet hose assembly to the air cleaner and throttle body.

(13) Connect the battery negative cable.

CYLINDER HEAD COVERS—(ENGINE REMOVED)

This procedure should be used when the engine is removed from the vehicle.

CAUTION: The right and left hand cylinder head covers and cylinder head cover gasket are not interchangeable.

Removal

(1) Remove cylinder head cover mounting bolts from the left and right sides (Fig. 6).

(2) Remove the covers and gaskets.

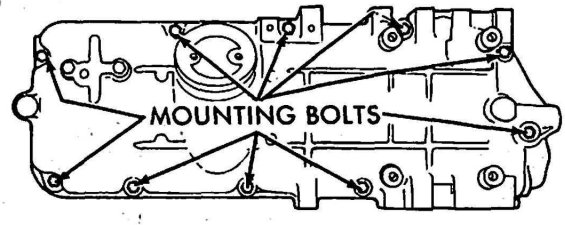
(3) Discard the gaskets. DO NOT reuse the gaskets.

Installation

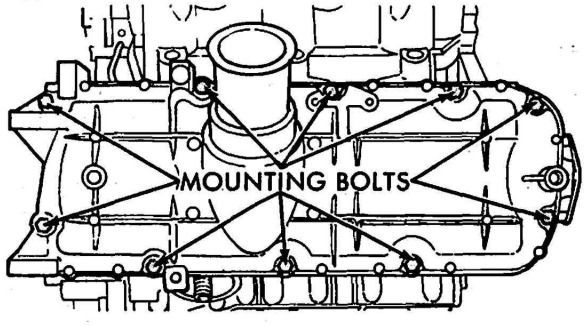
(1) Prior to installing a new cylinder head cover gasket, apply a dab of Jeep/Eagle Gasket-in-a-Tube Sealer at the timing cover to cylinder head mating seams (Fig. 7).

(2) Use new gaskets and install the right cylinder head cover and the left cylinder head cover. The right and left cylinder head gaskets are not identical.

(3) Tighten the mounting bolts to 12 N·m (9 ft-lbs) torque.



RIGHT SIDE



LEFT SIDE E8909-269

Fig. 6—Cylinder Head Covers

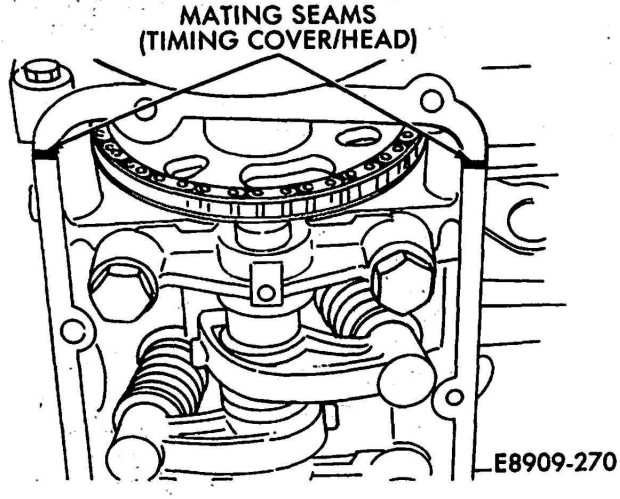


Fig. 7—Timing Cover to Head Mating Seam

CYLINDER HEAD—(ENGINE INSTALLED)

This procedure should be used with the engine installed in the vehicle.

CAUTION: Before removing the cylinder heads, allow the engine to cool down to room temperature. Never remove a cylinder head from a hot/warm engine. The cylinder head may warp.

When removing the cylinder head, the exhaust manifolds must be removed from the cylinder head. Install the exhaust manifolds AFTER the cylinder head and gasket have been installed. This is to prevent damage to the cylinder head gasket tabs.

Removal—Right Side

(1) Disconnect the battery negative cable.

(2) Drain the cooling system (refer to Group 7, Cooling System, for the proper procedure).

(3) Remove the intake manifold.

(4) Remove A/C Pump (if so equipped) Refer to Accessory Drive Section in Group 7 to remove drive belt.

(5) Remove the exhaust manifold.

(6) Remove the cylinder head gasket.

(7) Remove the spark plug wires from the cylinder head.

(8) Remove the top alternator mounting bracket that bolts to the cylinder head and the timing case cover.

(9) Remove the timing case bolts that thread into the cylinder head and those bolts in-line below.

The timing chain and sprocket must be held in place and not allowed to drop down while the cylinder head is removed. If the chain and sprocket slip, the timing case must be removed and the chain tensioners released.

(10) Turn the engine over until the camshaft sprocket dowel is straight up.

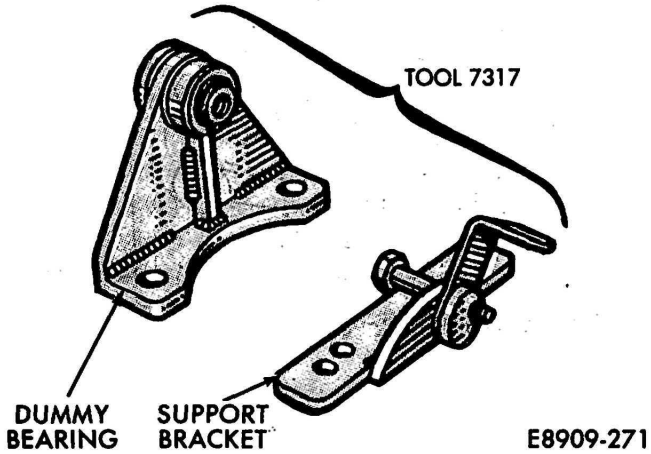


Fig. 1—Camshaft Sprocket Support—Tool 7317

(11) Attach Tool 7317 to the timing case cover. Secure with two short cylinder head cover bolts. The tool consists of a support bracket and a dummy bearing (Fig. 1).

(12) Position the adjusting lever behind the camshaft sprocket. Thread the adjusting lever bolt through the front of the tool, sprocket and into the lever (Fig. 2). Push the lever up as far as possible. Tighten the adjusting lever bolt.

(13) Unthread the plug in the front of the timing case cover (Fig. 3). This will give access to the camshaft sprocket bolt.

(14) Remove the cylinder head bolts.

(15) Remove the rocker arm shaft assembly (Fig. 4). The caps are pinned into the top of the cylinder head and will only go on in one direction.

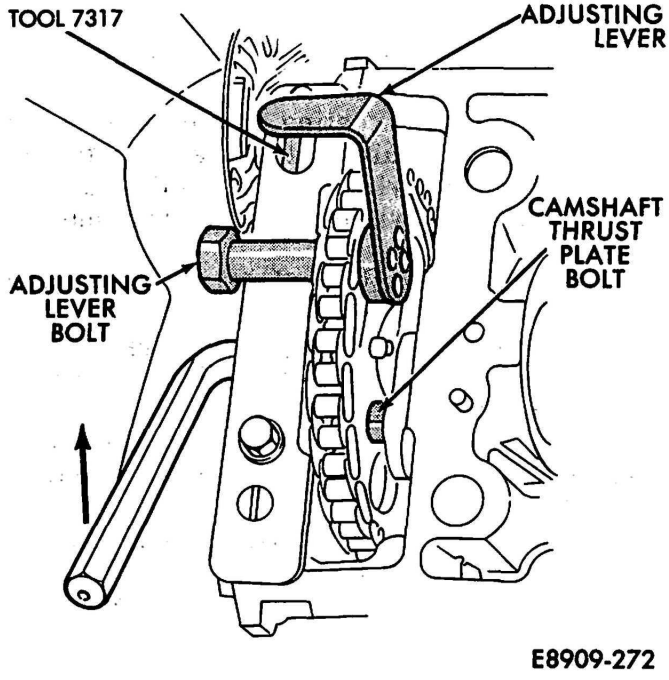


Fig. 2—Positioning Tool 7317

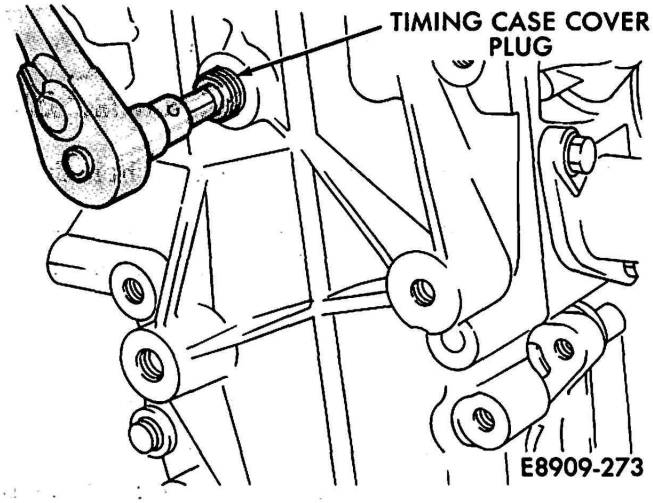


Fig. 3—Timing Case Cover Plug

(16) Install one head bolt in the center and tighten about 2 turns.

(17) Remove the camshaft cover and gasket at the rear of the cylinder head.

(18) Loosen the camshaft thrust plate bolt (Fig. 5). Pull the plate up and tighten the bolt. This will allow the camshaft to move back as the sprocket bolt is removed.

(19) Loosen the camshaft sprocket bolt and pull the camshaft back until the bolt is out of the camshaft. The bolt will stay in the sprocket hole. It will not drop down because the timing case cover is too close for it to come out of the sprocket.

(20) Slide the camshaft back away from the sprocket.

(21) Use an old push rod or a long thin drift punch as a tool and insert it into the front and rear cylinder head bolt holes on the exhaust manifold side of the head. (Fig. 6). Tap the dowels down below the head gasket.

Do not lift/pry the cylinder head straight up. This will cause the cylinder liners to come up and out of the block.

(22) Position a small piece of wood against the rear intake manifold side of the cylinder head and strike it with a hammer. Now position the piece of wood against the front exhaust manifold side of the cylinder head and strike it with a hammer. Repeat until the cylinder head is loose (Fig. 7).

(23) Remove the cylinder head bolt.

(24) Remove the cylinder head.

(25) Remove the cylinder head gasket.

CAUTION: Never rotate the engine with the support bracket of tool 7317 installed.

(26) Install liner clamps (Tool 7315) between the cylinder liners to hold them in place.

(27) Use tool 7314 to remove the cylinder head locating dowels (Fig. 8).

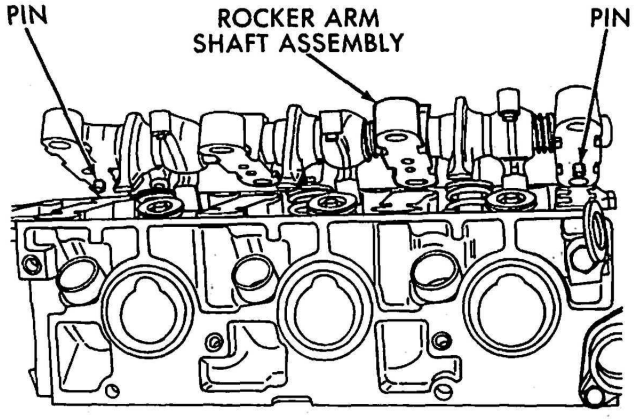


Fig. 4—Rocker Arm Shaft Assembly

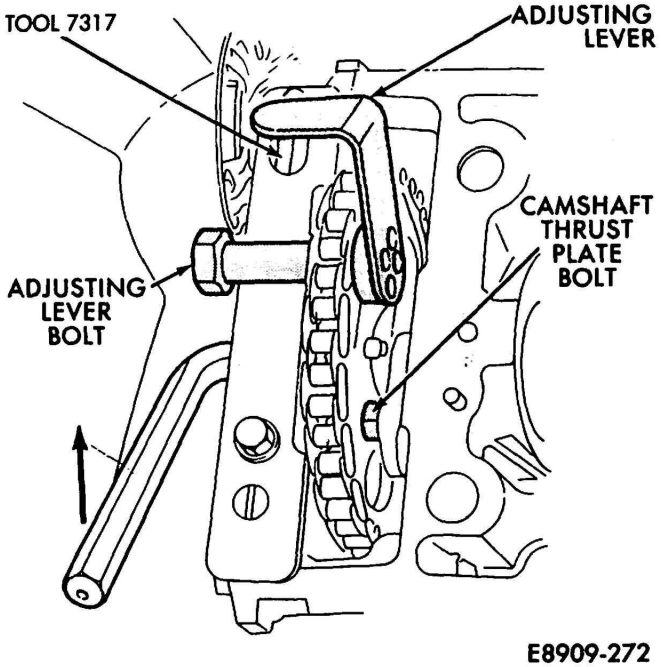


Fig. 5—Camshaft Thrust Plate Bolt

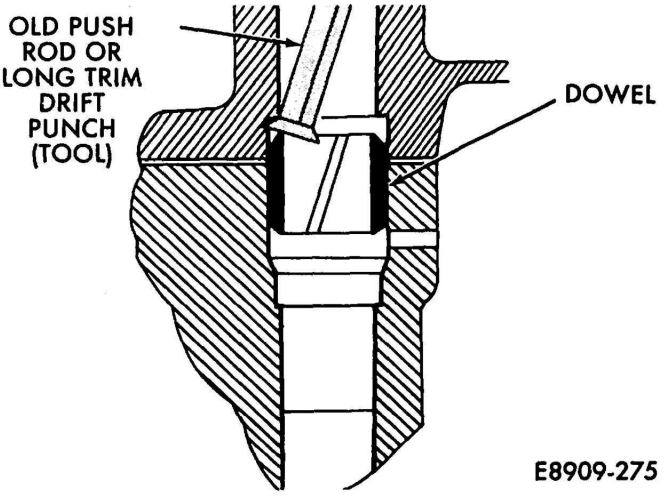


Fig. 6—Tap Dowel into Block

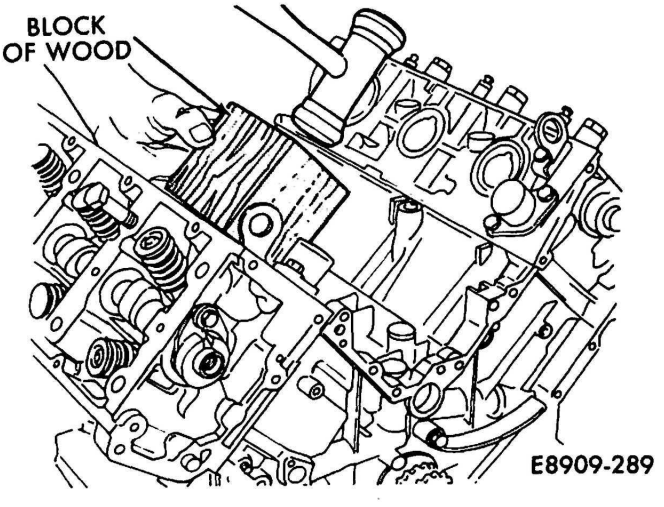


Fig. 7—Cylinder Head Removal

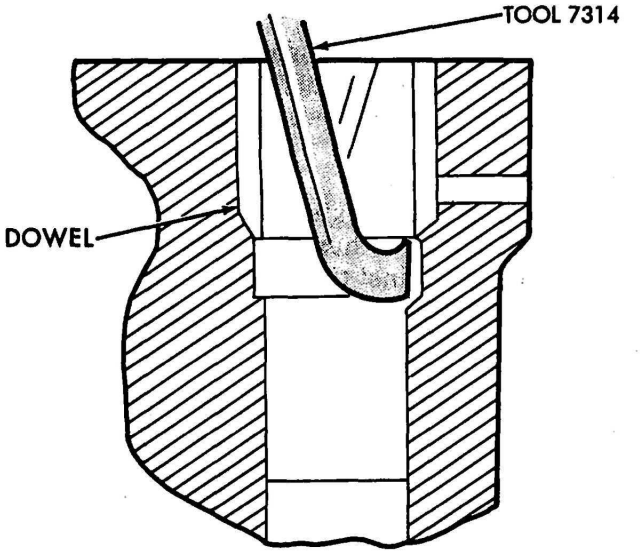


Fig. 8—Dowel Extractor Tool—7314

(28) Stuff the tops of the cylinder bores with clean lint free shop towels.

(29) Remove the liner hold down clamps (Tool 7315) to clean the cylinder block, then reinstall the liner clamps.

(30) Use a gasket removal compound to soften the old gasket material.

CAUTION: When cleaning the cylinder head and block mating surfaces, do not use a metal scraper because the surfaces could be cut or ground. Instead, use a wooden or plastic scraper.

(31) Make sure the gasket and/or foreign material does not enter the oil feed hole or the oil return hole (Fig. 9).

(32) Rinse and wipe clean the cylinder block and cylinder head mating surfaces.

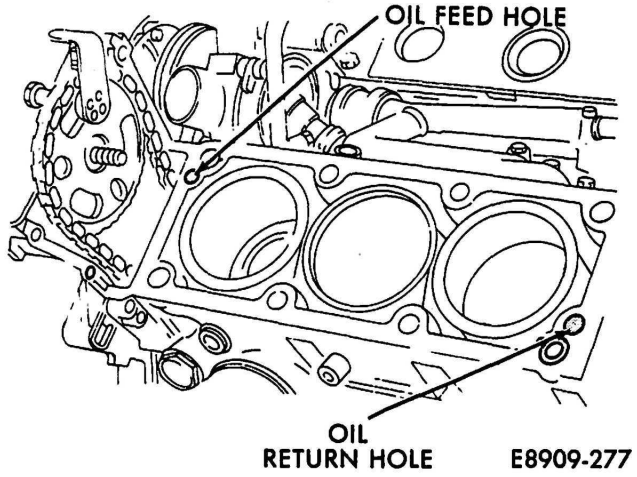


Fig. 9—Oil Feed and Return Holes

(33) Check the liner protrusion. The liner protrusion should be between 0.05 mm and 0.12 mm (.002 in and .005 in). Refer the Cylinder Liner—Piston—Connecting Rod Section for the proper procedure.

Installation—Right Side

(1) Cut the timing case cover gasket flush with the cylinder head gasket face.

(2) Cut sections from new gaskets and attack them to the timing case cover. Apply a thin bead of weather strip adhesive. Allow to dry.

(3) Install 3 mm pin punches into the holes in the block below the locating dowel bolt holes. Push the dowels in the holes until they contact the 3 mm pin punches (Fig. 10).

(4) Remove the shop towels from the cylinder bores.

(5) Install a new cylinder head gasket over the alignment dowels.

(6) Place a thin strip of MOPAR Gasket-in-a-Tube Sealer, or equivalent, where the cylinder head gasket contacts the timing case cover gasket.

(7) Install the cylinder head, taking care not to dislodge the timing case cover gasket.

(8) Insert the timing case cover to cylinder head mounting bolts and tighten them finger tight.

(9) Position the camshaft into the sprocket. Line up the dowel to the slot in the camshaft. Install the sprocket bolt and lightly tighten it.

(10) Remove support bracket assembly (Tool 7317).

(11) Loosen the camshaft thrust plate bolt and slide the plate into the groove in the cylinder head. Tighten the bolt to 12 N·m (9 ft-lbs) torque.

(12) Remove the 3 mm pin punches.

(13) Install the rocker shaft assembly and the cylinder head bolts.

(14) Tighten the cylinder head bolts in the sequence shown (Fig. 11).

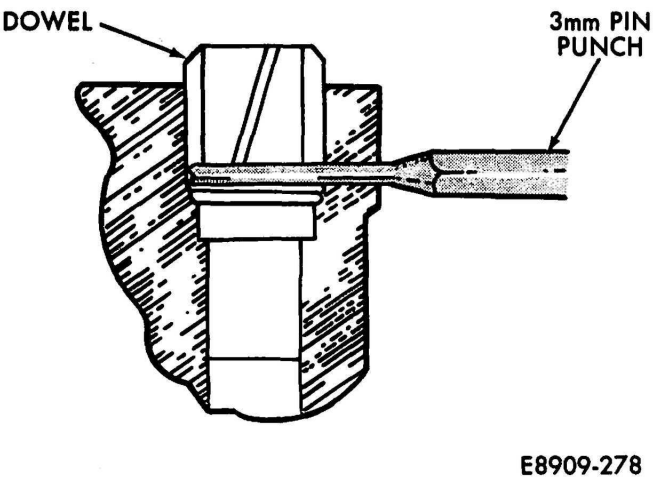


Fig. 10—Locating Dowel

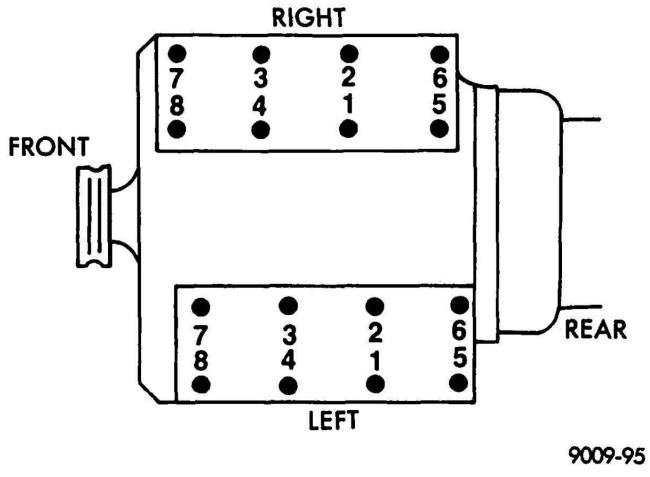


Fig. 11—Cylinder Head Bolt Tightening Sequence

(15) Starting with bolt No. 1, pre-tighten all bolts to 60 N·m (44 ft-lbs) torque.

(16) The following is performed on all bolts, one bolt at a time.

(a) Starting with bolt No. 1, loosen the bolt completely.

(b) Tighten bolt No. 1 to 40 N·m (30 ft-lbs) torque.

(c) Place the graduated disc (Tool 7321) between the socket and the torque wrench (Fig. 12).

(d) Turn the graduated disc clockwise until the locking stem rests against a solid object which will prevent the disc from turning.

(e) Angle tighten bolt No. 1 to 180° ± 20°.

(f) Repeat the procedure for all bolts in the above sequence.

(17) Tighten the timing case cover bolts to 12 N·m (9 ft-lbs) torque.

(18) Tighten the camshaft sprocket bolt to 80 N·m (59 ft-lbs) torque.

(19) Cut off any timing case cover gasket flush with the cylinder head.

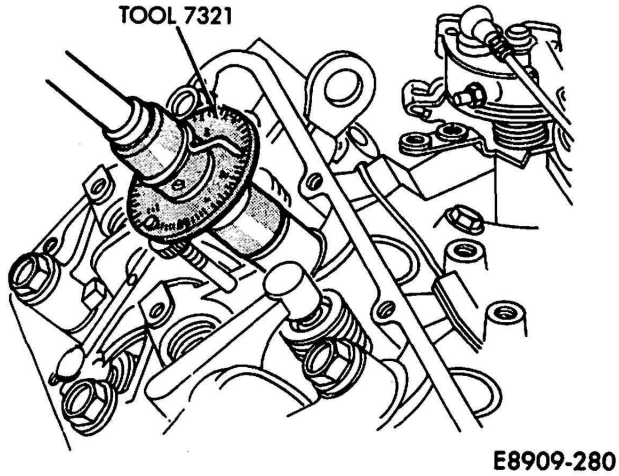


Fig. 12—Graduated Disc for Angular Tightening

(20) Install the cylinder head cover(s), exhaust manifold(s) and intake manifold.

(21) Coat the threads of the timing case cover plug with Loctite PST pipe sealant #592 or equivalent.

(22) Install the plug in the front of the timing case cover.

(23) Install the spark plug wires.

(24) Connect the alternator bracket.

(25) Fill and bleed the cooling system (refer to Group 7, Cooling System, for the proper procedure).

(26) Reset the accessory belt tension (refer to Group 7, Cooling System, for the proper procedure).

(27) Connect the battery negative cable.

Removal—Left Side

(1) Disconnect the battery negative cable.

(2) Drain the cooling system (refer to Group 7, Cooling System, for the proper procedure).

(3) Remove the intake manifold.

(4) Remove the exhaust manifold(s).

(5) Remove the cylinder head cover(s).

(6) Remove the spark plug wires from the spark plugs.

(7) Remove the distributor cap, rotor and dust shield.

(8) Turn the engine until the camshaft dowel pin is towards the top of the engine.

The timing chain must be held in place and not allowed to drop down when removing the cylinder head. If the chain and sprocket slip, the timing case cover must be removed and the timing chain tensioners released.

(9) Use tool 7317 to support the camshaft sprocket and chain while removing the cylinder head cover. The tool consists of a support bracket and a dummy bearing (Fig. 13).

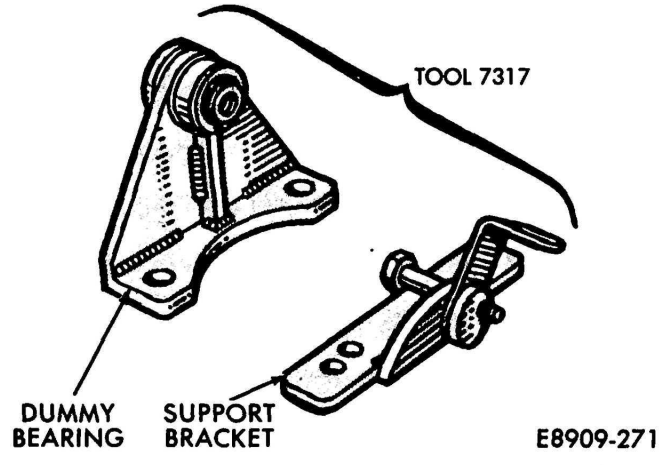


Fig. 13—Camshaft Sprocket Support—Tool 7317

(10) Remove the bolt and adjusting lever from the bracket(s). Place the bracket on top of the timing case cover. Use two cylinder head cover bolts to mount it.

(11) Thread the adjusting lever bolt through the bracket(s), the sprocket and into the adjusting lever, finger tight.

(12) Pull the adjusting lever up tight. Tighten the adjusting lever bolt.

(13) Loosen the camshaft thrust plate bolt. Pull the thrust plate up and away from the camshaft. Tighten the camshaft thrust plate bolt (Fig. 14).

(14) Remove the timing case cover to cylinder head mounting bolts.

(15) Place a socket or wrench on the crankshaft pulley nut to prevent the engine from turning over.

(16) Loosen the camshaft sprocket bolt (D).

(17) Loosen and remove the cylinder head bolts. Remove the rocker shaft assembly (note that the caps are pinned into the head and will only go on in one direction) (Fig. 15).

(18) Position one head bolt into a middle bolt hole. Tighten the bolt 2 turns.

(19) Use an old push rod or a long thin drift punch as a tool and insert it into the front and rear cylinder head bolt holes on the exhaust manifold side of the head (Fig. 16). Tap the dowels down below the head gasket.

Do not lift/pry the cylinder head straight up. This can cause the cylinder to pull up and out of the block.

(20) Place a piece of wood against the cylinder head and strike it with a hammer. Repeat on all sides of the cylinder head until the head is loose (Fig. 17).

(21) Remove the cylinder head bolt.

(22) Remove the cylinder head.

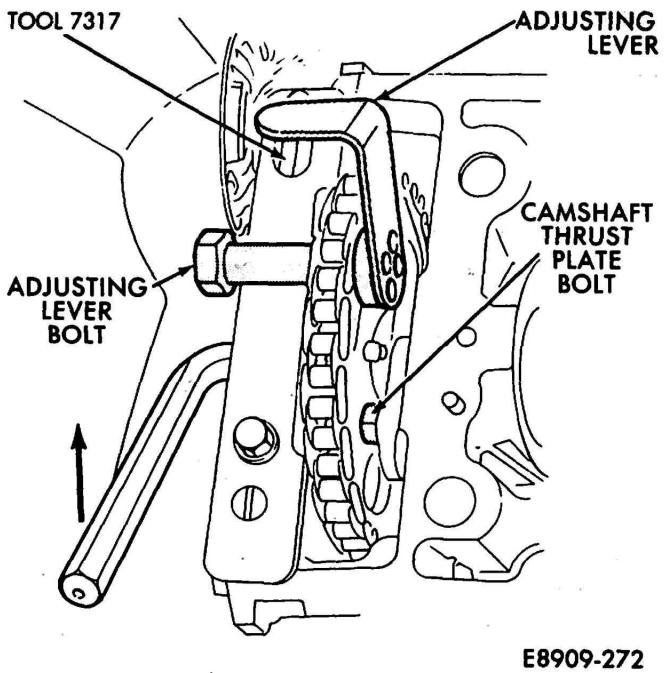


Fig. 14—Positioning Tool 7317

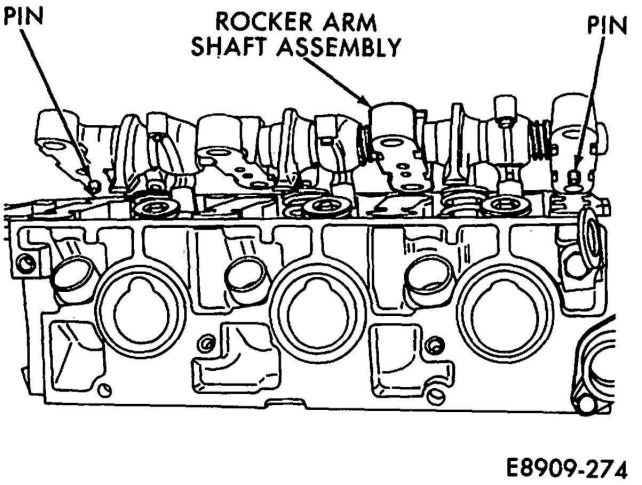


Fig. 15—Rocker Arm Shaft Assembly

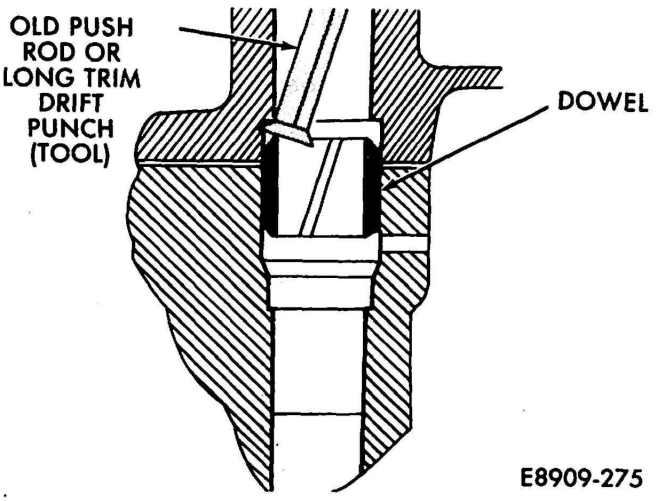


Fig. 16—Tap Dowel into Block

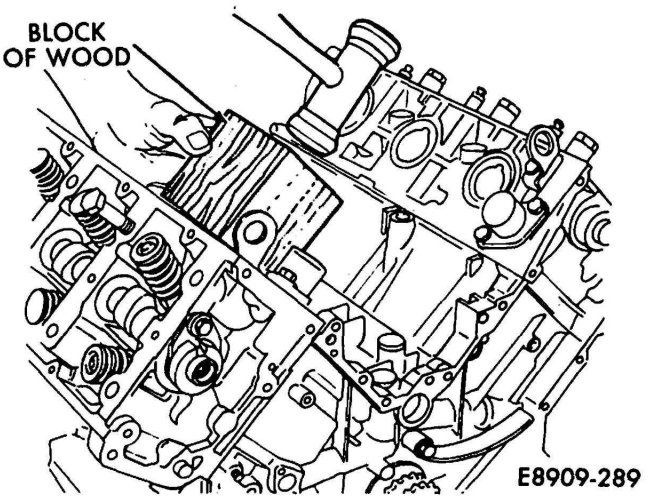


Fig. 17—Cylinder Head Removal

(23) Remove the cylinder head gasket.
(24) Use tool 7314 to remove the cylinder head locating dowels (Fig. 18).
(25) Stuff the cylinder bores with clean lint free shop towels.
(26) Install cylinder liner clamps (Tool 7315) to hold the liners in place.
(27) Use a gasket removal compound to soften the old gasket material.
CAUTION: When cleaning the cylinder head and block mating surfaces, do not use a metal scraper because the surfaces could be cut or ground. Instead, use a wooden or plastic scraper.
(28) Make sure that gasket and/or foreign material does not enter the oil feed hole or the oil return hole (Fig. 19).

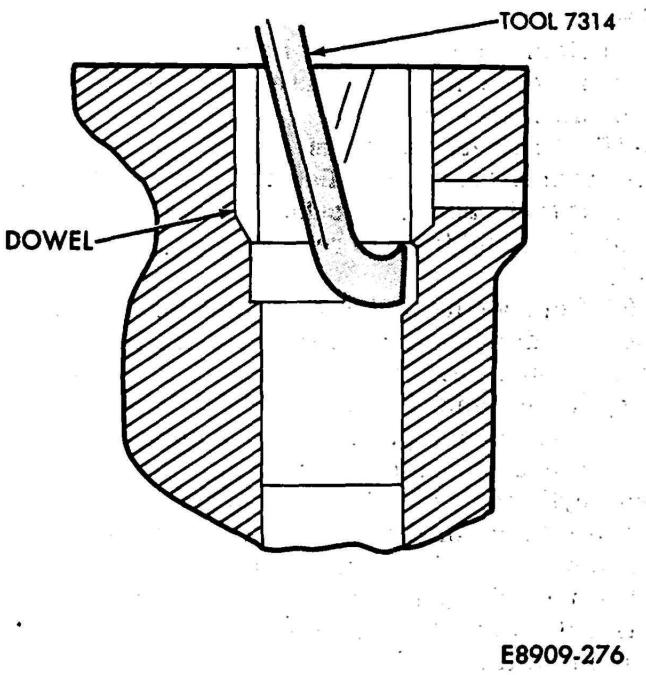


Fig. 18—Dowel Extractor Tool—7314

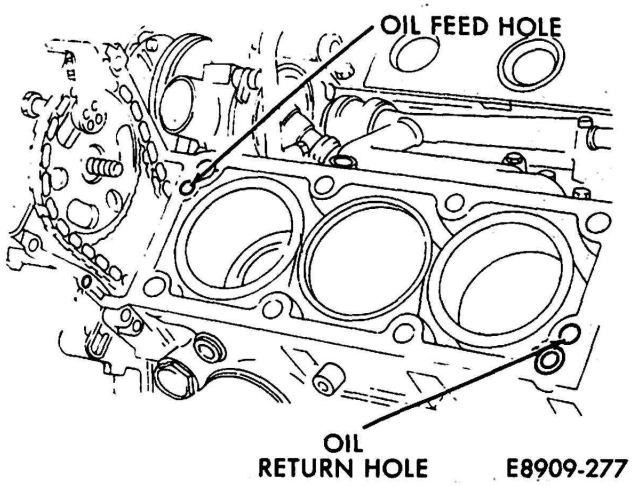


Fig. 19—Oil Feed and Return Holes

(29) Rinse and wipe clean the cylinder block and cylinder head mating surfaces.
(30) Check the liner protrusion. The liner protrusion should be between 0.05 mm and 0.12 mm (.002 in and .005 in). Refer to Cylinder Liner—Piston—Connecting Rod Section for the proper procedure.

Installation—Left Side

(1) Cut the timing case cover gasket flush with the cylinder head gasket face.
(2) Cut sections from the new gaskets and apply a thin bead of weather strip adhesive to them. Attach them to the timing case cover. Allow to dry.
(3) Install 3 mm pin punches into the holes in the block below the locating dowel bolt holes (Fig. 20). Push the dowels in the holes until they contact the 3 mm pin punches.
(4) Remove the shop towels from the cylinder bores.
(5) Install a new cylinder head gasket over the alignment dowels.
(6) Place a thin strip of MOPAR Gasket-in-a-Tube Sealer, or equivalent, where the cylinder head gasket contacts the timing case cover gasket.
(7) Install the cylinder head, taking care not to dislodge the timing case cover gasket.
(8) Insert the timing case cover to cylinder head mounting bolts and tighten them finger tight.
(9) Position the camshaft into the sprocket. Line up the dowel to the slot in the camshaft. Install the sprocket bolt and lightly tighten it.
(10) Remove bracket assembly (Tool 7317).
(11) Loosen the camshaft thrust plate bolt and slide the plate into the groove in the cylinder head. Tighten the bolt to 12 N·m (9 ft-lbs) torque.
(12) Remove the 3 mm pin punches.
(13) Install the rocker shaft assembly and the cylinder head bolts.

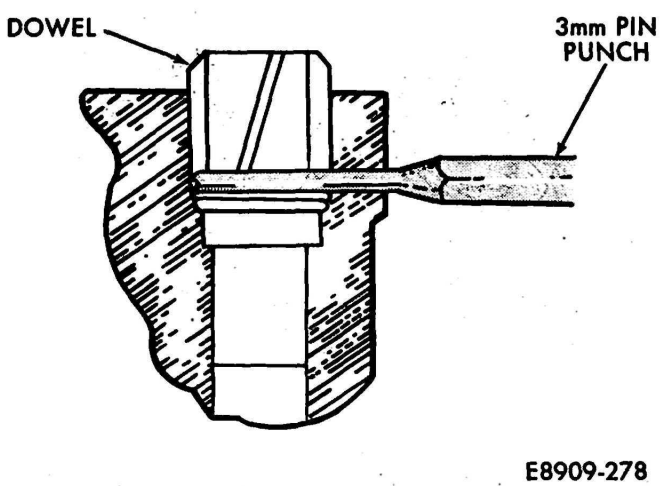


Fig. 20—Locating Dowel

(14) Tighten the cylinder head bolts in the sequence shown (Fig. 21).

(15) Starting with bolt No. 1, pre-tighten all bolts to 60 N·m (44 ft-lbs) torque.

(16) The following is performed on all bolts, one bolt at a time.

(a) Starting with bolt No.1, loosen the bolt completely.

(b) Tighten bolt No. 1 to 40 N·m (30 ft-lbs) torque.

(c) Place the graduated disc (Tool 7321) between the socket and the torque wrench (Fig. 22).

(d) Turn the graduated disc clockwise until the locking stem rests against a solid object which will prevent the disc from turning.

(e) Angle tighten bolt No. 1 to 180° ± 20°

(f) Repeat the procedure for all bolts in the above sequence.

(17) Tighten the timing case cover bolts to 12 N·m (9 ft-lbs) torque.

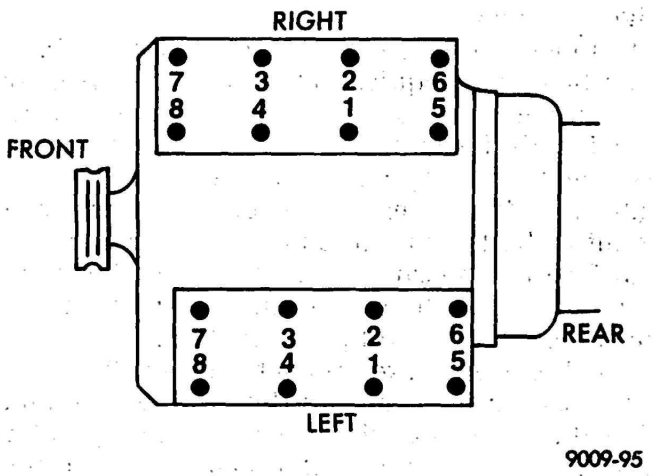


Fig. 21—Cylinder Head Bolt Tightening Sequence

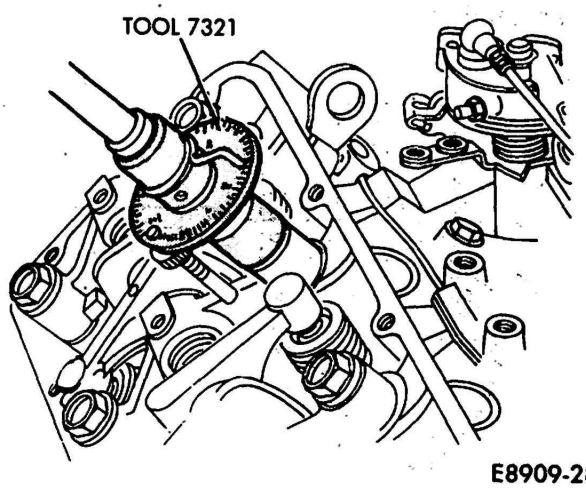


Fig. 22—Graduated Disc for Angular Tightening

(18) Tighten the camshaft sprocket bolt to 80 N·m (59 ft-lbs) torque.

(19) Cut off any timing case cover gasket flush with the cylinder head.

(20) Install the cylinder head cover(s), exhaust manifold(s) and intake manifold.

(21) Install the distributor cap/rotor/dust shield.

(22) Install the spark plug wires.

(23) Fill and bleed the cooling system (refer to Group 7, Cooling System, for the proper procedure).

(24) Connect the battery negative cable.

CYLINDER HEAD—(ENGINE REMOVED)

This procedure should be used when the engine is removed from the vehicle.

Removal

(1) Remove the cylinder head covers.

(2) Remove the timing case cover, timing chains and camshaft sprockets.

CAUTION: Never use an air impact gun to remove the cylinder head bolts. Damage may result to the threads in the aluminum cylinder block.

(3) Use hand tools to remove the cylinder head bolts.

(4) Remove the rocker arm shaft assembly from the cylinder head. Note that pins in the bottom of front and rear pedestals index the assembly to cylinder head (Fig. 1).

(5) Use an old push rod or a long thin drift punch as a tool and insert it into the front and rear cylinder head bolt holes on the exhaust manifold side of the head (Fig. 2). Tap the dowels down below the head gasket.

Do not lift/pry the cylinder head straight up, this will cause the cylinder liners to come up and out of the block.

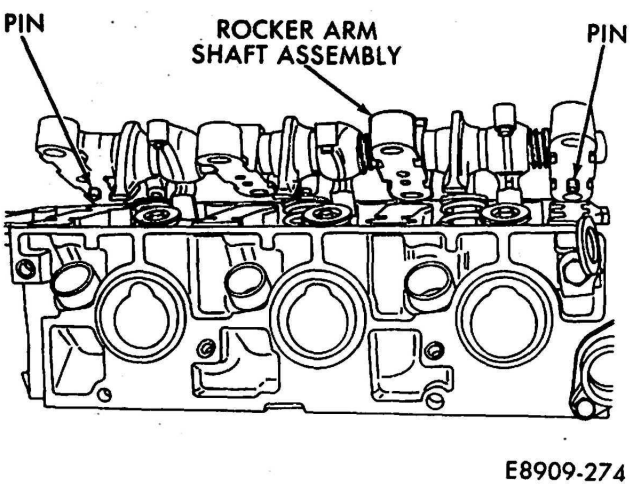


Fig. 1—Rocker Arm Shaft Assembly

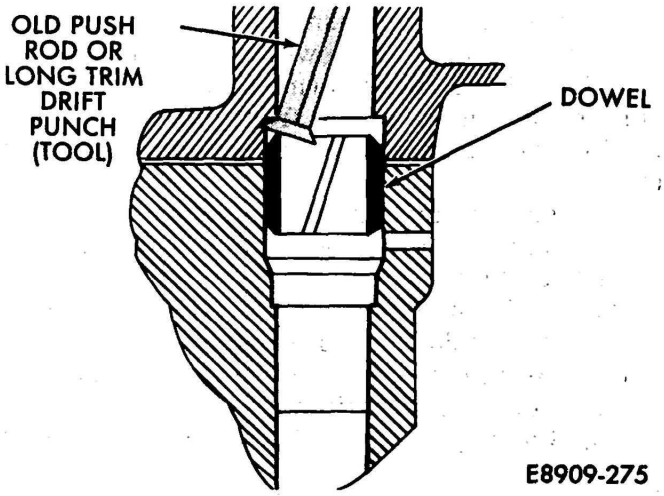


Fig. 2—Tap Dowel into Block

(6) Install one cylinder head bolt into a center hole to hold the cylinder head in place.

(7) Position a small piece of wood against the rear intake manifold side of the cylinder head and strike it with a hammer (Fig. 3). Now position the piece of wood against the front exhaust manifold side of the cylinder head and strike it with a hammer. Repeat until the cylinder head is loose.

(8) Remove the cylinder head bolt.

(9) Remove the cylinder head.

(10) Remove the cylinder head gasket.

(11) Use a gasket removal compound to soften the old gasket material.

CAUTION: When cleaning the cylinder head and block mating surfaces, do not use a metal scraper because the surfaces could be cut or grooved. Instead, use a wooden or plastic scraper.

(12) Make sure that gasket and/or foreign material does not enter oil feed hold or oil return hole (Fig. 4).

(13) Rinse and wipe clean the cylinder block and cylinder head mating surfaces.

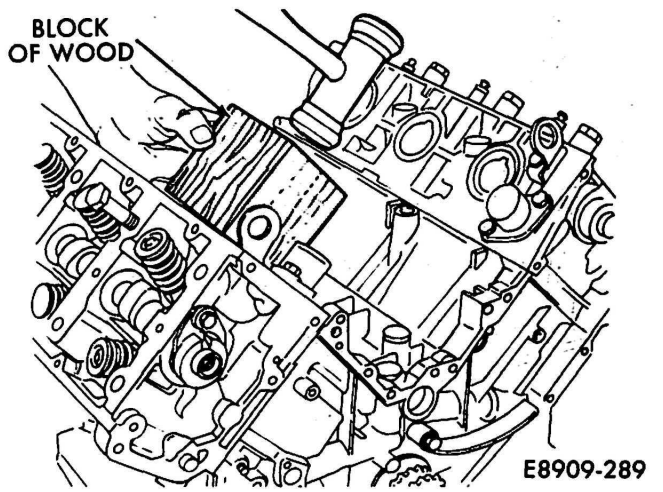


Fig. 3—Cylinder Head Removal

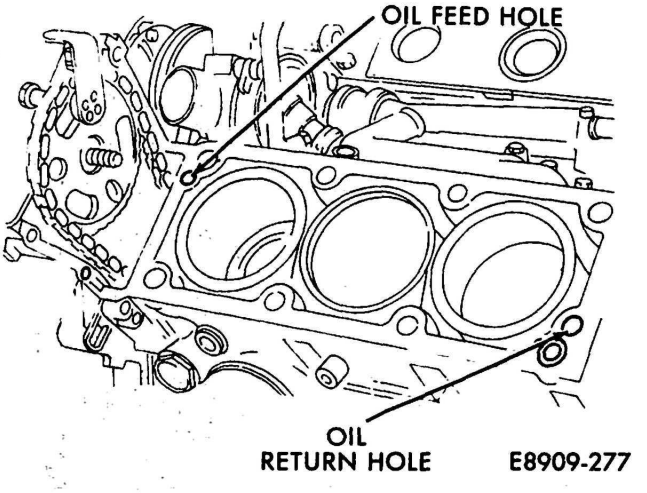


Fig. 4—Oil Feed and Return Holes

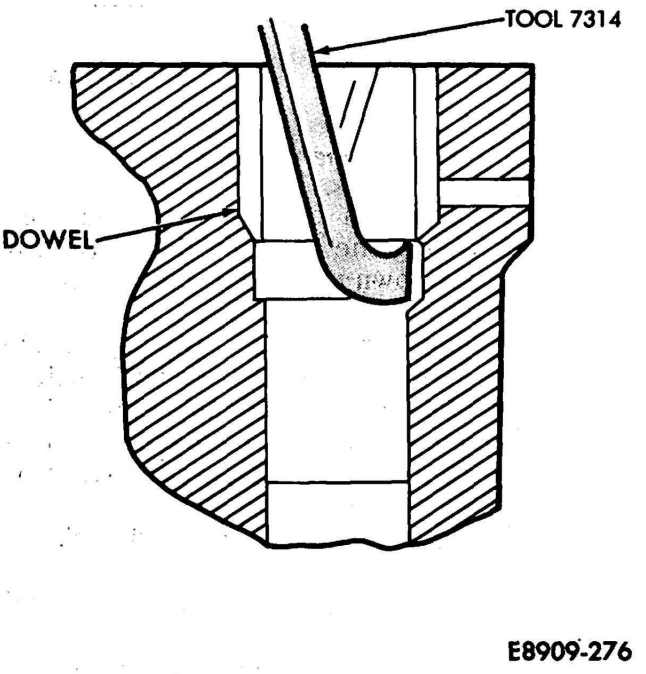


Fig. 5—Dowel Extractor Tool—7314

(14) Use Tool 7314 to remove the cylinder head locating dowels (Fig. 5).

(15) Install liner clamps (Tool 7315) between the cylinder liners to hold them in place (Fig. 6).

Installation

The cylinder head gaskets are not identical. The left hand gasket has a larger cut out at the front than the right hand gasket (Fig. 7).

(1) Pull the cylinder head dowels up using extractor (Tool 7314)—(Fig. 5).

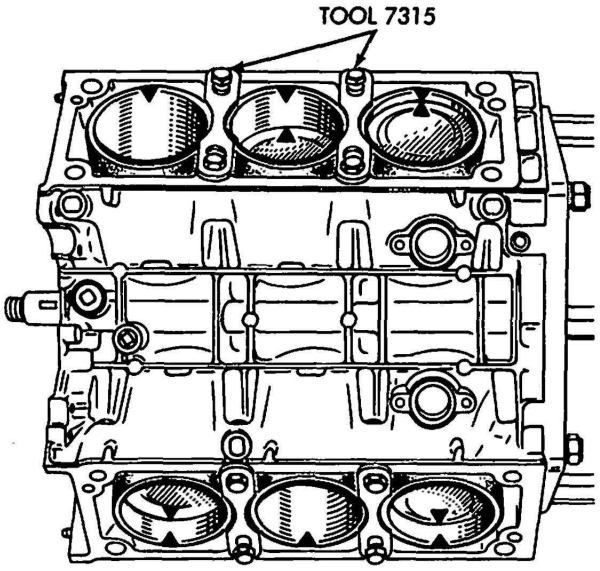


Fig. 6—Liner Clamps

(2) Install 3 mm pin punches into the holes in the block below the locating dowel (Fig. 8). Push the dowels down until they contact the pin punches.

(3) Rotate the crankshaft until the keyway slot is pointing straight up (Fig. 9). This will position the No. 1 piston below top dead center (TDC) and prevent contact between pistons and valves.

(4) Remove the liner clamps (Tool 7315) from the left cylinder head (Fig. 9).

(5) Install dry, a new cylinder head gasket to the left cylinder bank.

(6) Turn the engine on the engine stand until the left bank points straight up.

(7) Position the left cylinder head over the new head gasket.

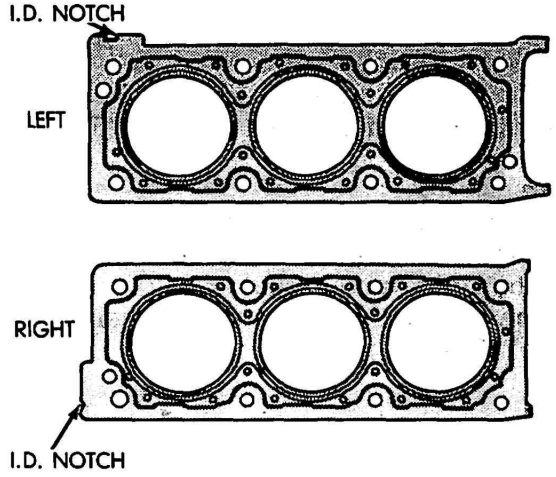


Fig. 7—Cylinder Head Gaskets

(8) Turn the left chamshaft until the slot in the front is positioned as shown in (Fig. 10).

(9) Install the rocker arm shaft. Note that the pins in the bottom of the front and rear pedestals index the assembly to the cylinder head (Fig. 11).

(10) Remove the 3 mm pin punches.

(11) Lightly oil the threads and install the cylinder head bolts.

(12) Starting with bolt No. 1, pretighten all bolts in sequence to 60 N·m (44 ft-lbs) torque (Fig. 12).

(13) The following procedure is performed on all bolts, one bolt at a time.

(a) Starting with bolt No. 1, loosen the bolt completely.

(b) Tighten bolt No. 1 to 40 N·m (30 ft-lbs) torque.

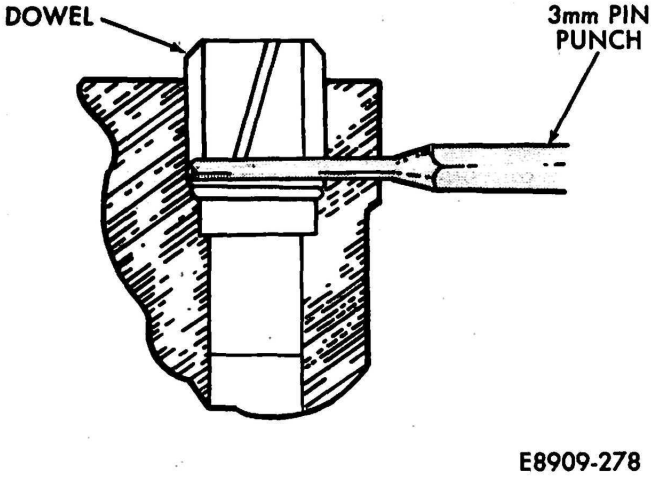


Fig. 8—Locating Dowel

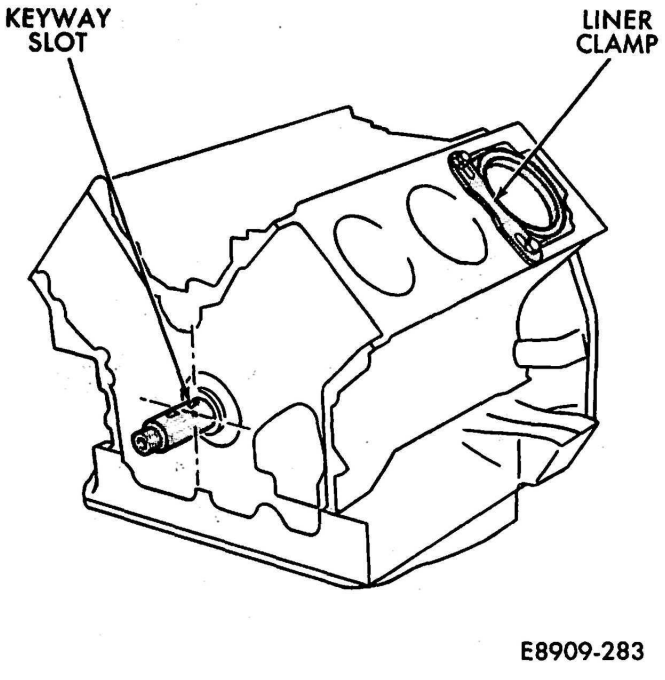


Fig. 9—Position of Keyway Slot/Liner Clamps

(c) Place the graduated disc (Tool 7321) between the socket and the torque wrench (Fig. 13).

(d) Turn the graduated disc clockwise until the locking stem rests against a solid object which will prevent the disc from turning.

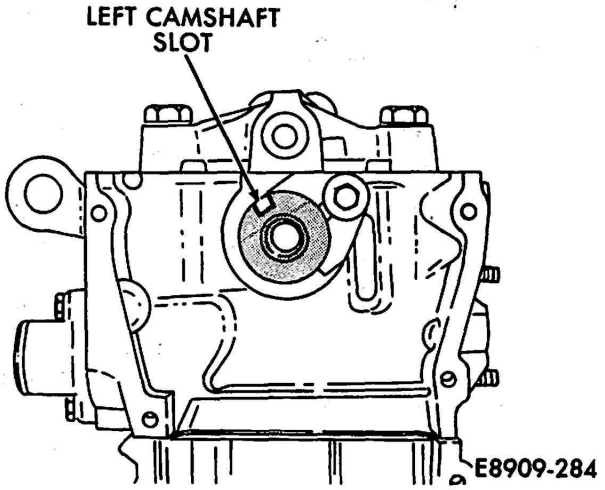


Fig. 10—Position of Left Camshaft Slot

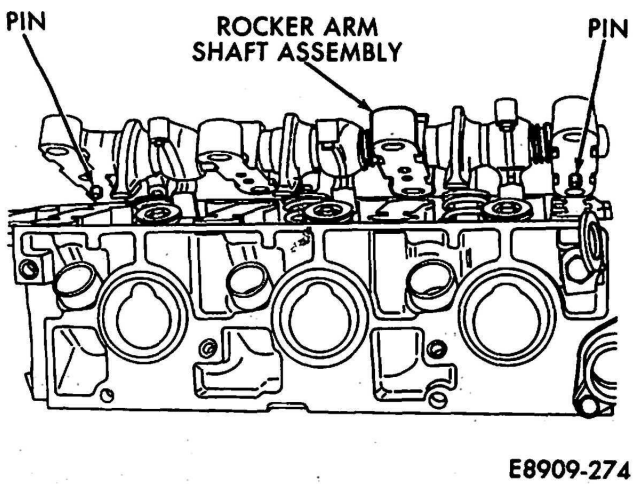


Fig. 11—Rocker Arm Shaft Assembly

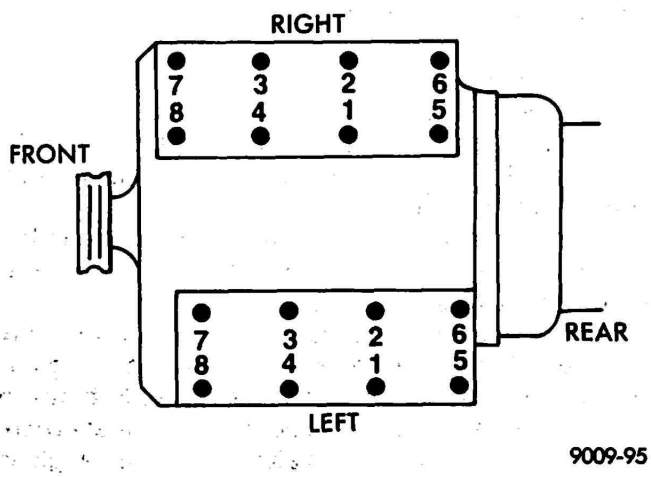


Fig. 12—Cylinder Head Bolt Tightening Sequence

(e) Angle tighten bolt No. 1 180° ± 20°.

(f) Repeat the procedure for all bolts in the above sequence (Steps a–e).

(14) Turn the engine on the stand until the right bank points up.

(15) Pull the cylinder head dowels up using extractor (Tool 7314).

(16) Remove the cylinder liner clamps from the right bank.

(17) Install 3 mm pin punches into the holes in the block below the locating dowels. Push the dowels down until they contact the pin punches.

(18) Install dry, a new cylinder head gasket to the right cylinder head.

(19) Position the right cylinder head over the new head gasket.

(20) Turn the right camshaft until the slot in the front is positioned as shown in (Fig. 14).

(21) Install the rocker arm shaft. Note that the pins in the bottom of the front and rear pedestals index the assembly into the cylinder head (Fig. 8).

(22) Remove the 3 mm pin punches.

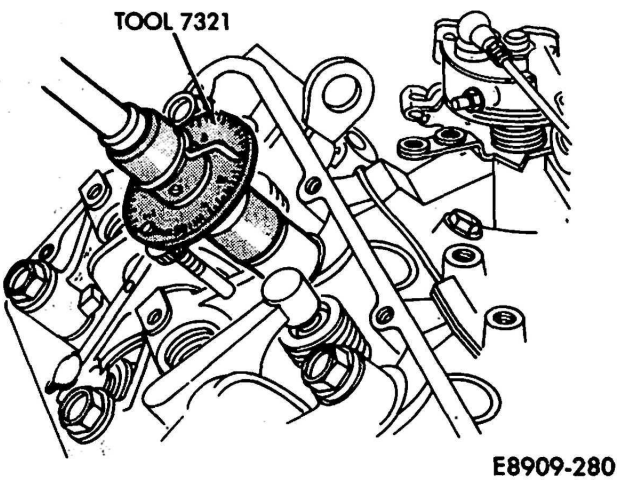


Fig. 13—Graduated Disc for Angular Tightening

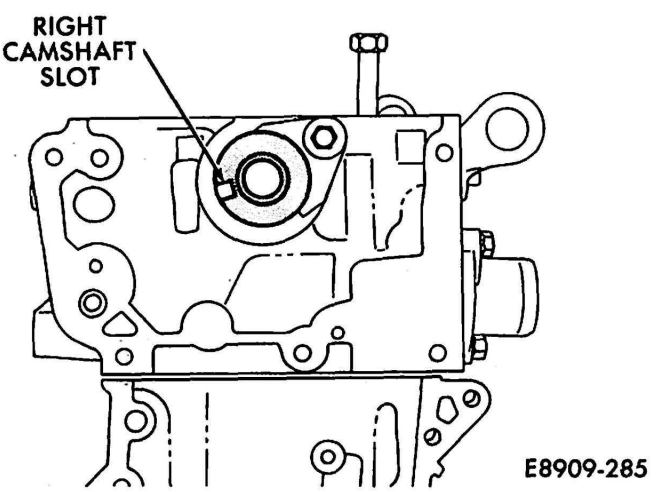


Fig. 14—Position of Keyway Slot

(23) Lightly oil the threads and install the cylinder head bolts.

(24) Starting with bolt No. 1, pretighten all bolts in sequence to 60 N·m (44 ft-lbs) torque (Fig. 12).

(25) The following procedure is performed on all bolts, one bolt at a time.

(a) Starting with bolt No. 1, loosen the bolt completely.

(b) Tighten bolt No. 1 to 40 N·m (30 ft-lbs) torque.

(c) Place the graduated disc (Tool 7321) between the socket and the torque wrench (Fig. 13).

(d) Turn the graduated disc clockwise until the locking stem rests against a solid object which will prevent the disc from turning.

(e) Angle tighten bolt No. 1 180° ± 20°.

(f) Repeat the procedure for all bolts in the above sequence (Steps a–e).

VALVE AND VALVE SPRINGS

Removal

(1) Remove the cylinder head.

(2) Use a valve spring compressor to compress the valve spring (Fig. 1).

(3) Remove the keepers, retainers, valve springs, spring washers and lay them out in the order that they were removed (Fig. 2).

(4) Check the valve keeper groove in the top of the valve stem for burrs prior to removing the valves. If burrs are found remove them with a jewelers file. Failure to remove the burrs will cause damage to the valve guide when the valve is removed.

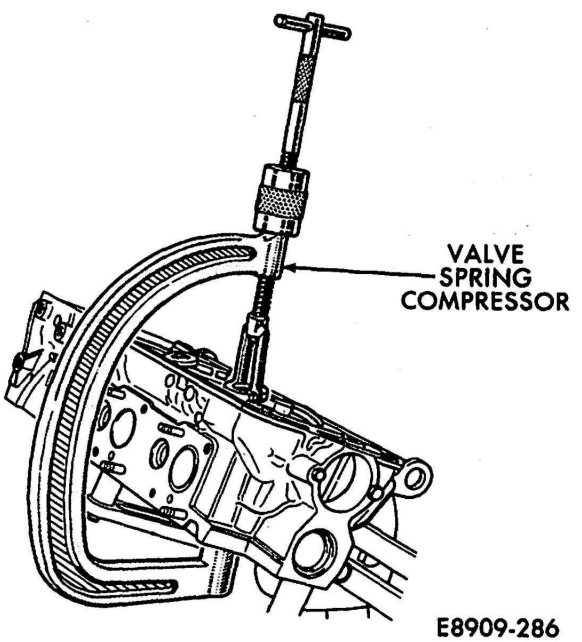


Fig. 1—Valve Spring Compressor

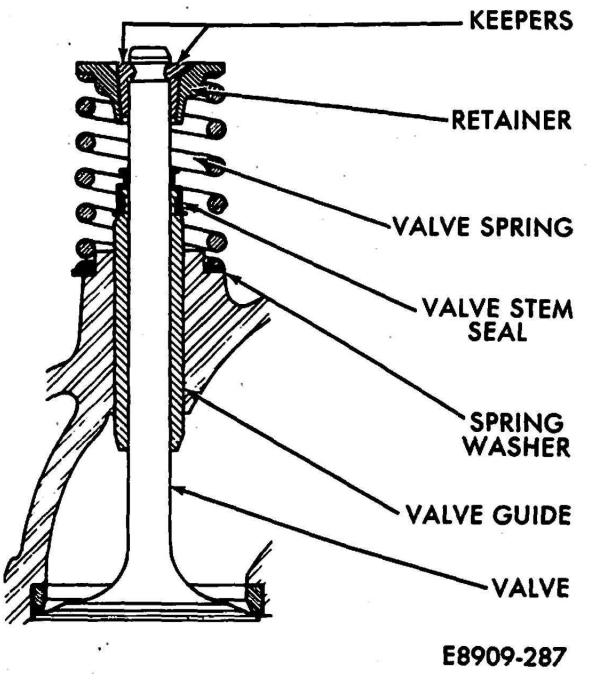


Fig. 2—Valve Components

VALVE GUIDES

NORMAL (NO GROOVES)—13.0 mm (0.512 in.)

REPAIR (TWO GROOVES) —13.35 mm (0.526 in.)

E8909-292

Fig. 3—Valve Guide Repair

(5) Use a grease pencil to mark the bottom of the valve with its cylinder number.

(6) Remove the valve from the guide and place it with the corresponding valve spring, keepers, retainer and spring washer (Fig. 2).

(7) Remove the valve stem seal from the top of the valve guide (Fig. 2).

Valve Guides

There is one repair size valve guide available. The repair guide outside diameter (size) can be identified by the number of grooves on the outside of the guide (Fig. 3).

(1) Press the old valve guides out of the cylinder head. Do not install the same size guide as the one that was removed.

The new valve guide must be installed with a 0.10 mm (.0039 inch.) interference fit between the guide and the valve guide bore. The valve guide bores in the cylinder head must be machined to the appropriate diameter for the repair valve guide. The angle is 16.5° (Fig. 4).

(2) Press the intake valve guides in until the bottom of the valve guide is 30 mm (1.181 in) from the top of the valve seat (Fig. 4).

(3) Press the exhaust valve guides in until the bottom of the valve guide is 26mm (1.024 in) from the top of the valve seat (Fig. 4).

(4) After the new guides are installed, ream the valve guides to 8 mm (0.315 in) and then grind the valve seats. To insure proper sealing between the valve and valve seats, the valve seats must be ground after a new valve guide has been installed and reamed to 8 mm (0.315 in).

(5) Clean the cylinder heads. Remove all metal chips and grinding dust from the valve guides and combustion chambers.

Installation

(1) Prior to assembling the cylinder head, stick each valve into its appropriate guide and slowly move it in and out. The valve should slide without drag. If a drag is felt, check both the guide and valve stem for burrs.

(2) Using the correct tool, install the valve stem seals. There are two valve stem seal installers. Tool #6187 is silver in color and stamped INTAKE. Tool #6200 is gold in color and stamped EXHAUST (Fig. 5).

(a) Position the seal on the tool pilot (Fig. 5).

(b) Install the pilot into the top of the valve guide and gently push down.

(c) Use a rubber mallet to lightly tap on the top of the seal installer until the tool stops. Remove the tool from the valve guide.

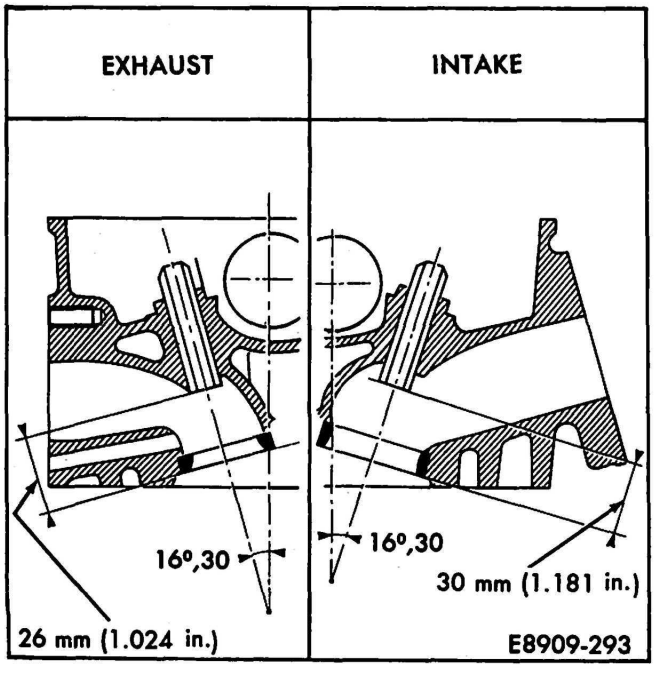


Fig. 4—Valve Guide Dimensions

(d) Lightly oil the valve guide stems and install them into the valve guides.

(3) Install spring washers, valve springs, retainers and keepers (Fig. 6).

ROCKER SHAFT

The left and right hand rocker shaft assemblies are identical and can be used on either cylinder head. When reusing rocker arm assemblies, always install them on the same cylinder head that they were removed from.

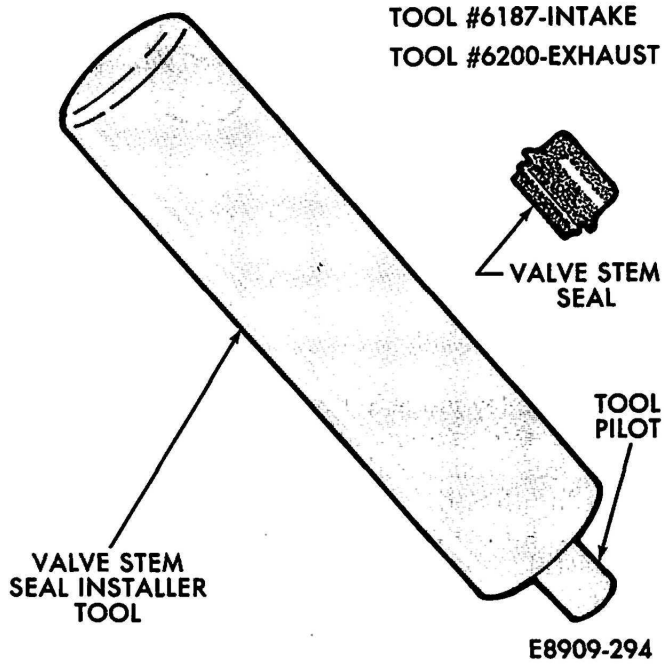


Fig. 5—Valve Stem Installer Tool

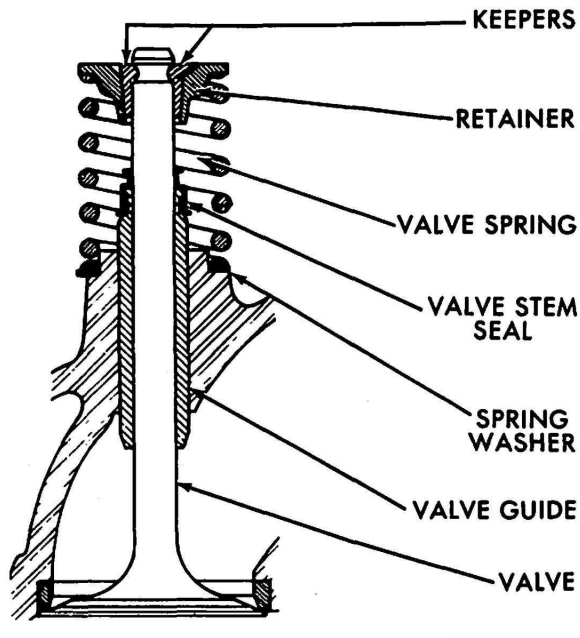


Fig. 6—Valve Components

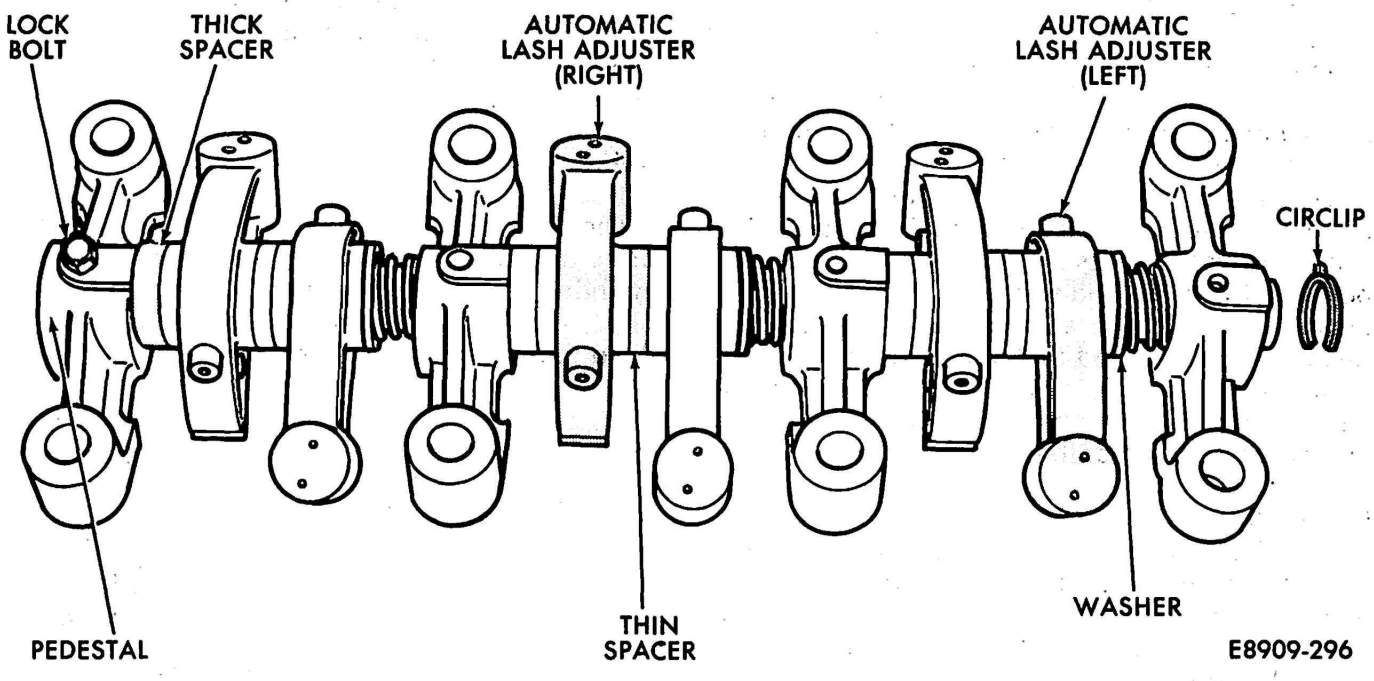


Fig. 7—Rocker Shaft Assembly

Disassembly

The oil galley plugs in the ends of the rocker shaft are pressed in and are not replaceable.

(1) When disassembling, arrange the parts in the order that they were removed. Remove the lock bolt and carefully remove in order (Fig. 7):

- Pedestal.
- Thick Spacer.
- Rocker arm with automatic lash adjuster on the right.
- Thin spacer.
- Rocker arm with automatic lash adjuster on the left.
- Spring.

(2) Remove the circlip from the end of the rocker shaft.

Assembly

(1) The rocker shaft can be installed only one way. There are two holes in the one end of the rocker shaft (top and bottom). The larger hole is at the top. This hole lines up with the set bolt when screwed into the end pedestal. The lock bolt will not fit into the smaller (bottom) hole. The circlip fits onto the other end of the shaft.

The oil feed holes in the rocker shaft must be clean and unplugged to ensure that oil travels to the rocker arm, automatic lash adjuster and the camshaft.

(2) When assembling, be sure that the flat machined surface of the pedestal faces the circlip (Fig. 8).

(3) Lightly coat the rocker shaft wiith clean engine oil.

(4) Assemble the rocker shaft in the correct order. Insert the lock bolt and tighten it to 6 N·m (53 in-lbs) torque.

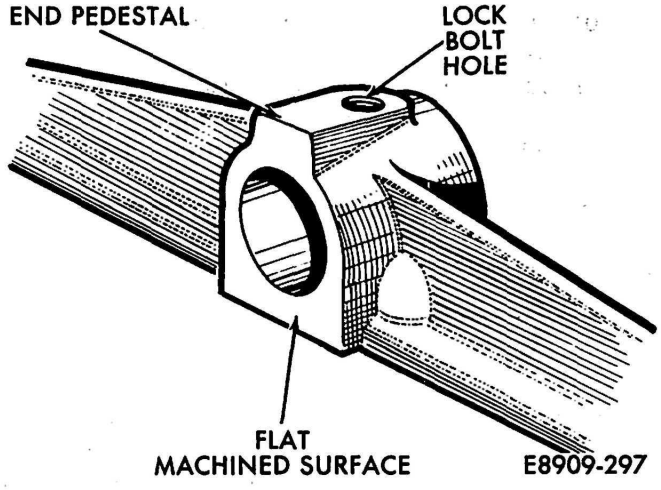


Fig. 8—Flat Machined Surface of Pedestal

HYDRAULIC TAPPET AND ROCKER ARM

A hydraulic tappet is located in each rocker arm. The tappet is in constant contact with the top of the valve stem and is nonadjustable. The rocker arms are serviced with lash adjusters. Valve lash is always zero. Oil pumped through the rocker shaft reaches the tappet through a passage in the rocker arm. The oil passes under slots in the tappet thrust washer and into the tappet body. Air and oil are bled off through two small holes above the thrust washer. A squirt

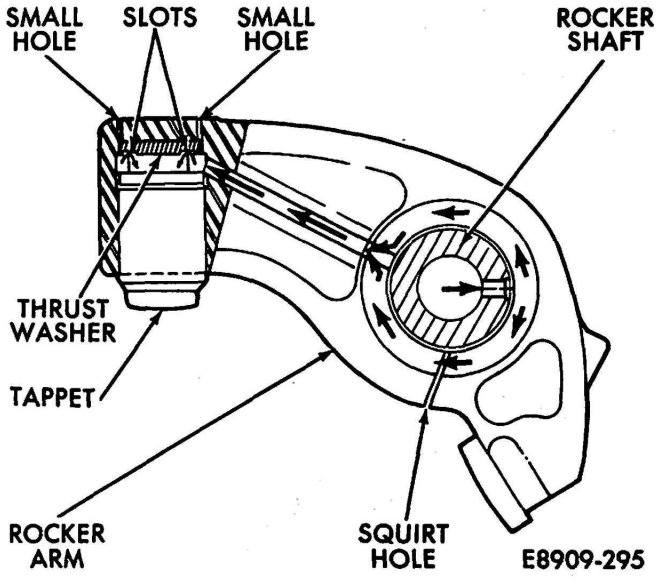


Fig. 9—Hydraulic Tappet and Rocker Arm

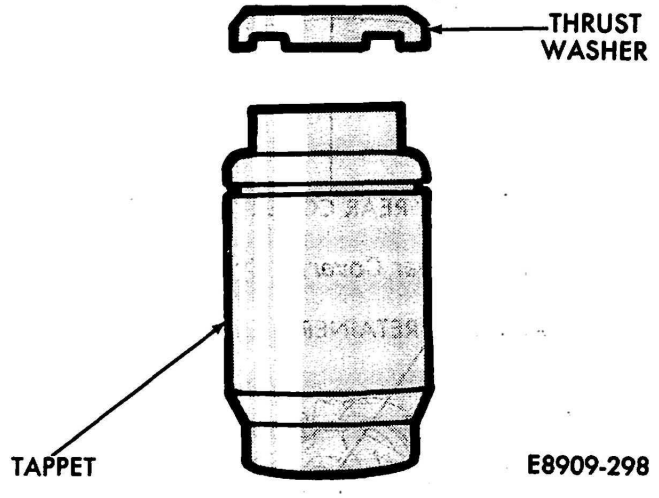


Fig. 10—Thrust Washer

hole lubricates the camshaft lobe (Fig. 9).

Disassembly

(1) Disassemble the rocker shaft assembly.

(2) Remove the tappet from the rocker arm (Fig. 9).

(3) Remove the thrust washer (Fig. 10).

(4) Use a straight edge to check the bottom of the tappet for a crown. If the tappet is worn flat or dished, replace it.

(5) Check the oil squirt hole in the rocker arm for blockage (Fig. 11). Use compressed air to clean out any blockage.

(6) Check the cam follower pad of the rocker arm for wear (Fig. 11). If the pad is flat and does not have a crown, replace the rocker arm and check the accompanying camshaft lobe for wear.

(7) Clean the rocker arms. Use compressed air

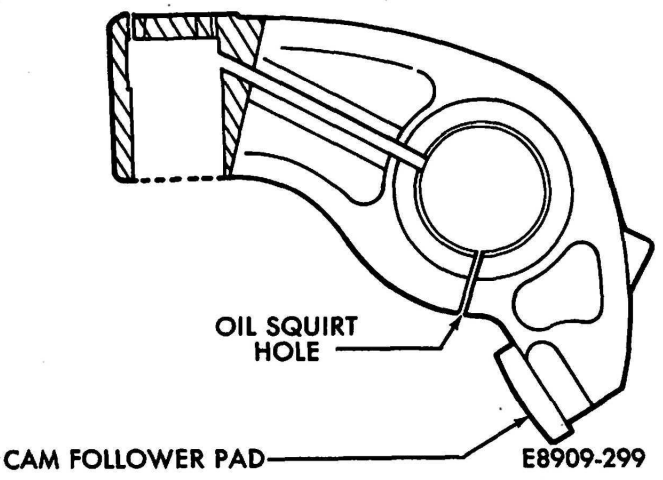


Fig. 11—Oil Squirt Hole/Cam Follower Pad

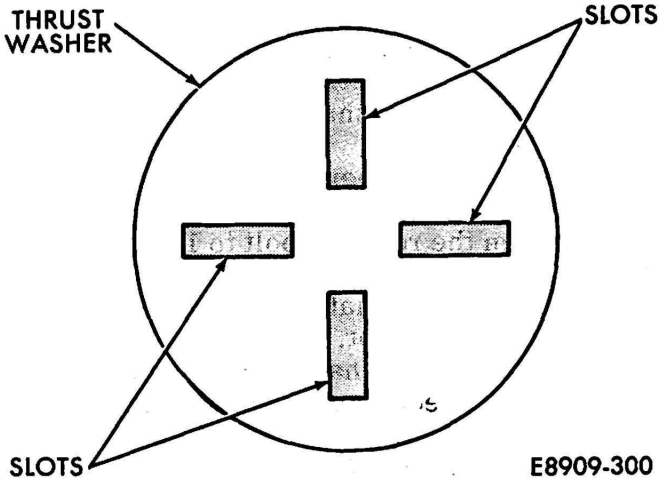


Fig. 12—Slots Face Tappet

to clean out the oil passage from the rocker shaft bore to the tappet bore and the oil squirt hole.

Assembly

(1) Lightly coat the tappet, thrust washer and tappet bore with clean engine oil.

CAUTION: When installing the thrust washer, the slots must face the tappet (Fig. 12). If the washer is installed incorrectly oil will not enter the tappet.

(2) Install the thrust washer with the slots toward the tappet.

(3) Install the tappet. The tappet may tend to fall out of the tappet bore. It may be necessary to use masking tape or tag wire to hold the tappet in place until the rocker shaft assembly is installed on the engine.

CAMSHAFTS

The right and left hand camshafts are not the same and cannot be interchanged. The camshafts can be identified by the location of the lobes.

On left-hand camshaft both lobes for each cylinder are on the same side (Fig. 13).

On right-hand camshaft the lobes for each cylinder are on opposite sides (Fig. 13).

The camshafts are removed and installed from the rear of the cylinder heads once they have been removed.

Removal

(1) Remove the cover at the rear of the cylinder head (Fig. 14).

(2) Loosen the camshaft retainer bolt and slide the retainer up and out of the groove in the camshaft (Fig. 15). Tighten the bolt.

(3) Slide the camshaft out the rear of the cylinder head.

(4) Replace any camshaft with worn lobes.

Installation

(1) Lubricate the camshaft journals with Jeep/Eagle Super Oil Conditioner.

(2) Install the camshaft from the rear of the cylinder head.

(3) Slide the retainer into the groove at the front of the camshaft.

(4) Tighten the retainer bolt to 12 N·m (9 ft-lbs) torque.

(5) Check the camshaft end play using a feeler gauge or dial indicator.

(a) Push the camshaft to the front.

(b) Insert a feeler gauge between the retainer and the front of the camshaft. Select a feeler gauge that drags as it is pulled through.

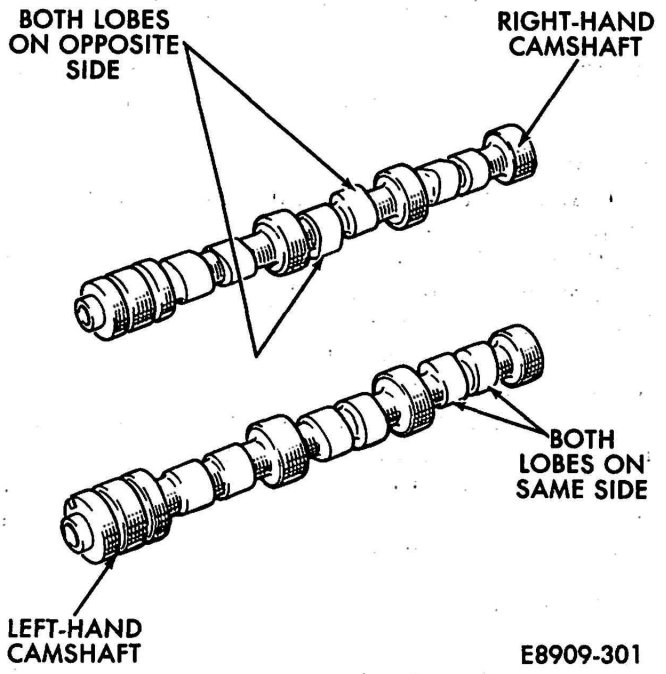


Fig. 13—Camshaft Identification

(c) The end play must be between 0.07 mm and 0.14 mm (.003 in and .0055 in.).

(6) Install the cover with a new gasket at the rear of the cylinder head. Coat the mounting bolt threads with Loctite 271 and tighten them to 6 N·m (53 in-lbs) torque.

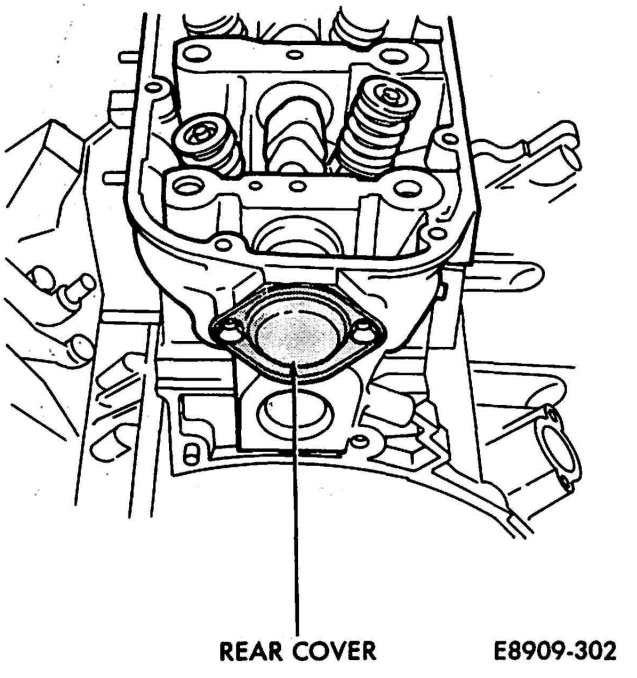


Fig. 14—Rear Cover of Cylinder Head

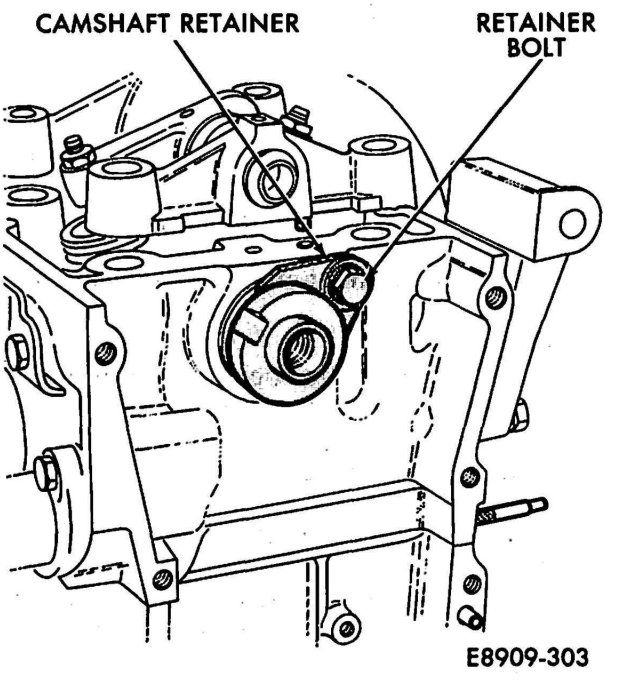


Fig. 15—Camshaft Retainer

WATER PUMP PULLEY

Refer to Group 7, Cooling System, for the proper procedure.

WATER PUMP

Refer to Group 7, Cooling System, for the proper procedure.

REAR CRANKSHAFT SEAL HOUSING

Removal

(1) Remove the bolts from the lower casing (Fig. 1).
(2) Remove seal housing mounting bolts (Fig. 1).
(3) Remove the seal housing and gasket.
(4) Push the old seal from the housing.

Installation

(1) Use a new gasket and install the seal housing to the cylinder block.
(2) Loosely install all bolts including the casing to seal housing bolts.
(3) Tighten the seal housing to block bolts first. Then tighten the casing to seal housing bolts. Tighten the mounting bolts to 12 N·m (9 ft-lbs) torque.
(4) Lightly oil the inner and outer edges of the new seal.
(5) Place the new seal on seal installer (Tool 6482) (Fig. 2).
(6) Install the new seal by gently tapping the end of Tool 6482 until the tool stops.
(7) Remove Tool 6482 turning the tool while pulling it out.

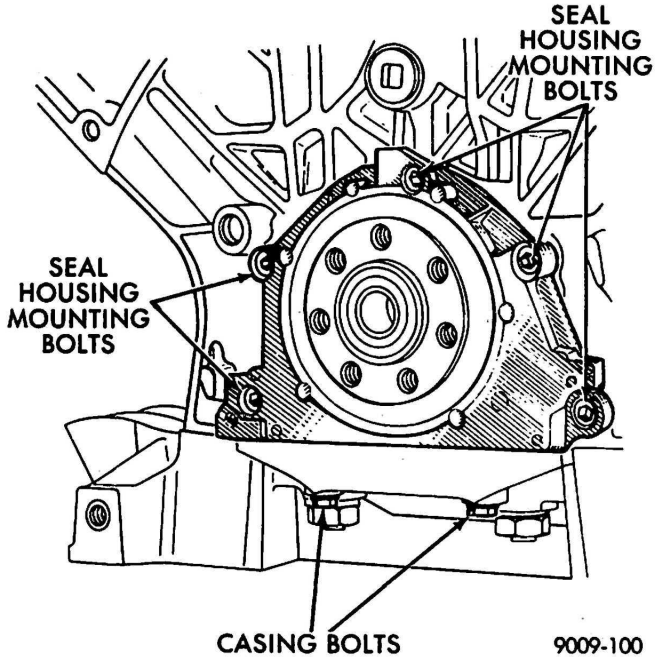


Fig. 1—Rear Crankshaft Seal Housing

CRANKSHAFT PULLEY/TIMING COVER

Removal—Crankshaft Pulley

(1) With the crankshaft rear main seal housing removed, install crankshaft turning Tool 6072 at the flywheel end of the crankshaft (Fig. 3).
CAUTION: Do not use an impact air gun to remove the crankshaft nut.

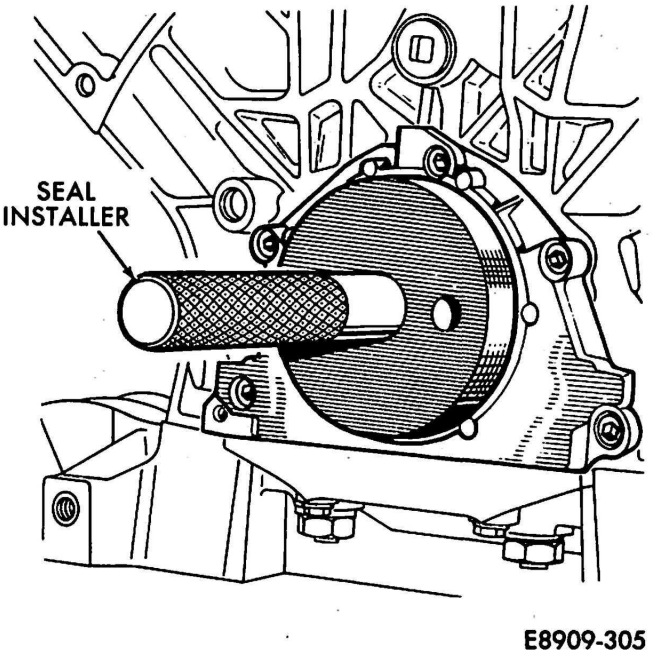


Fig. 2—Seal Installer Tool 6482

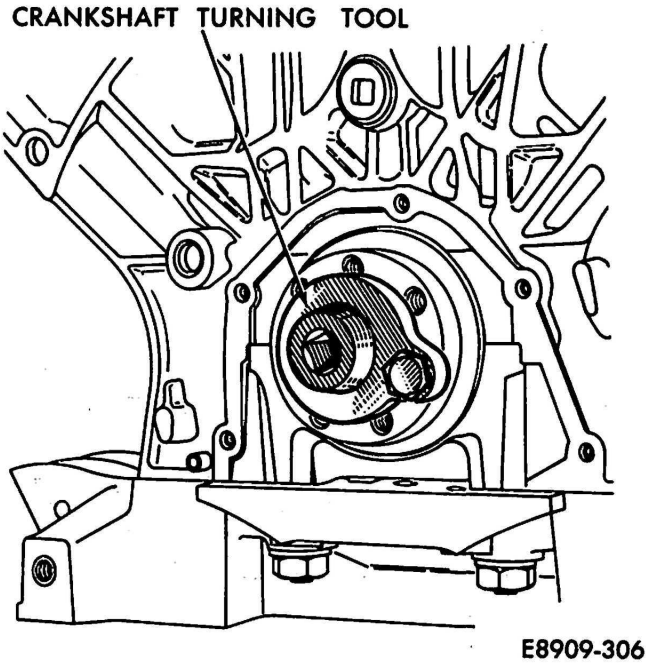


Fig. 3—Crankshaft Turning Tool 6072

(2) A thread lock is applied to the crankshaft pulley nut. Use a BRASS hammer and strike the nut prior to loosening. Remove the pulley nut.

(3) Check the position of the keyway slot (Fig. 4). The keyway slot must point straight up before removing the crankshaft pulley. The key could fall out of the crankshaft if the pulley is removed with the keyway facing down. If it does not point up, turn the crankshaft until it does.

(4) Pull the crankshaft pulley off the crankshaft (Fig. 4).

Removal—Timing Cover

(1) Remove the cylinder head covers.

(2) Hold the camshaft sprocket in place and remove the distributor drive/camshaft sprocket bolt.

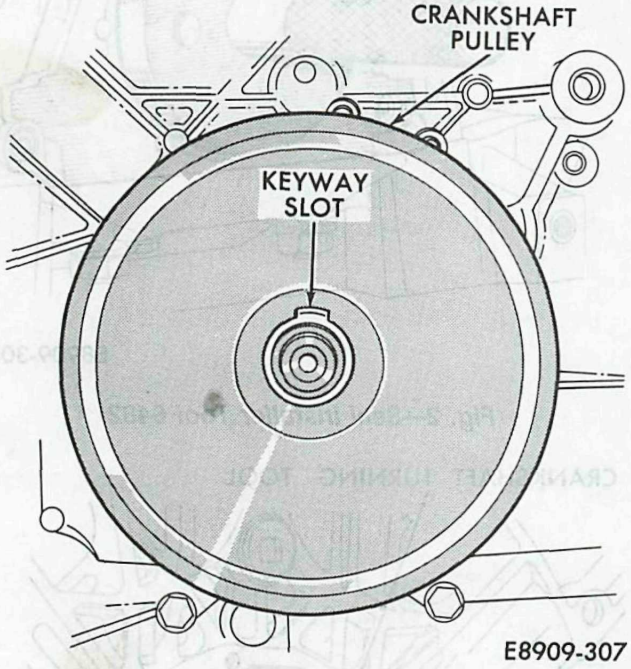


Fig. 4—Keyway Slot Position

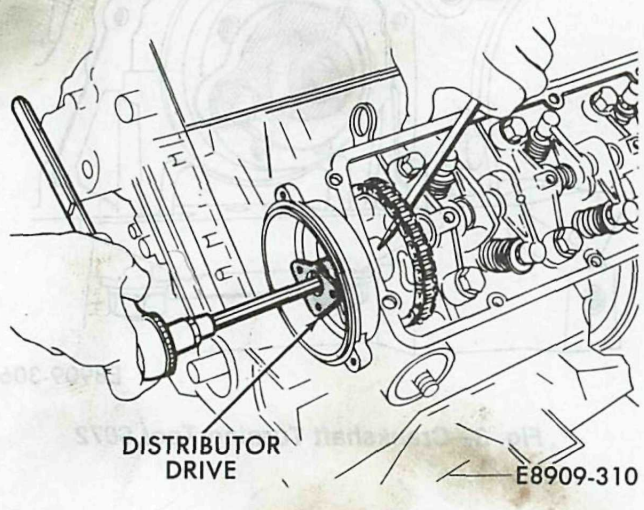


Fig. 5—Distributor Drive

(3) Pull distributor drive forward and off of the camshaft sprocket (Fig. 5).

(4) Remove the timing cover mounting bolt.

(5) Place a pry bar between the cylinder block and boss (Fig. 6) on the front cover and gently pry the cover off.

(6) Remove the gaskets.

Installation

(1) Rotate the crankshaft so that the keyway points up. This will prevent the key from falling into the oil pan.

(2) Put a small amount of Jeep/Eagle Gasket-in-a-Tube Sealer at the mating lines of the cylinder head and block and the lower casing to block.

(3) Install the timing cover with a new gasket over the alignment dowels (Fig. 7).

(4) Install the mounting bolts. On the four bottom bolts, apply Loctite 271 to the bolt threads (Fig. 8). Tighten all front cover bolts to 12 N·m (9 ft-lbs) torque.

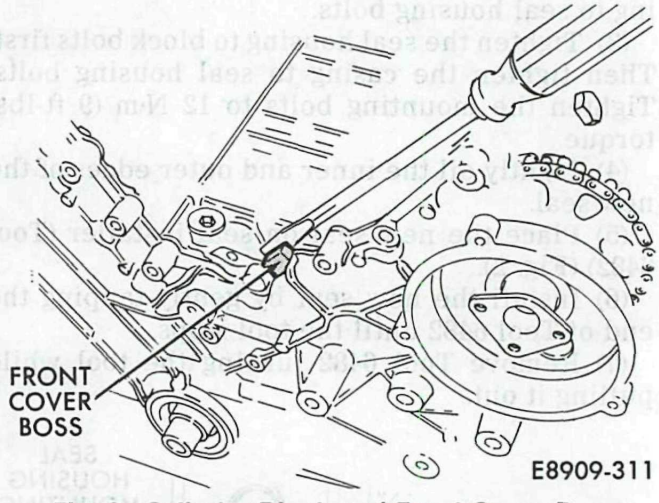


Fig. 6—Cylinder Block and Front Cover Boss

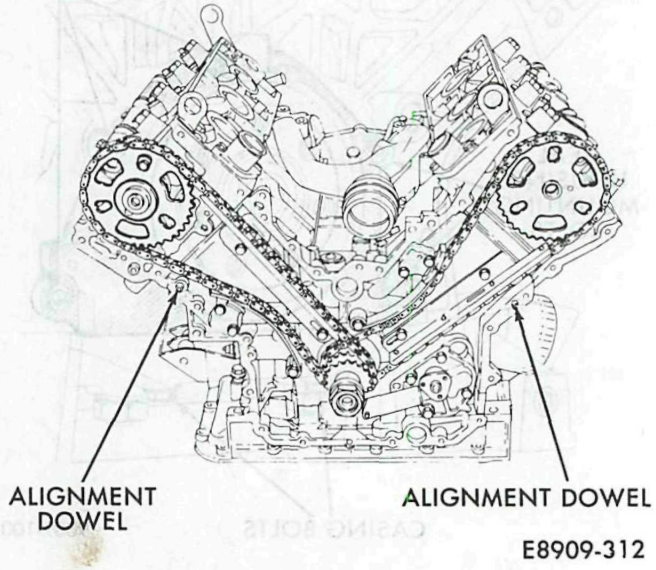


Fig. 7—Alignment Dowels

(5) Install the distributor drive/left camshaft sprocket mounting bolt. Tighten the bolt to 80 N·m (59 ft-lbs) torque.

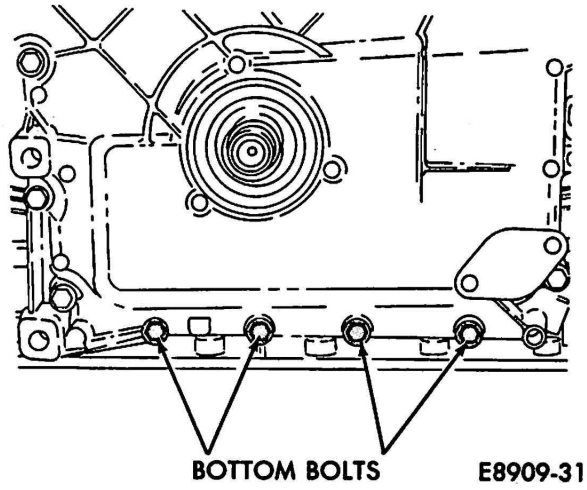


Fig. 8—Loctite 271 on Bottom Bolts

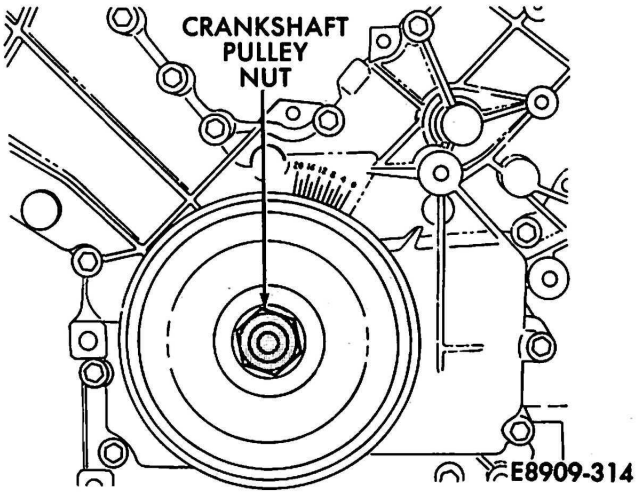


Fig. 9—Loctite 271 on Crankshaft Pulley Nut

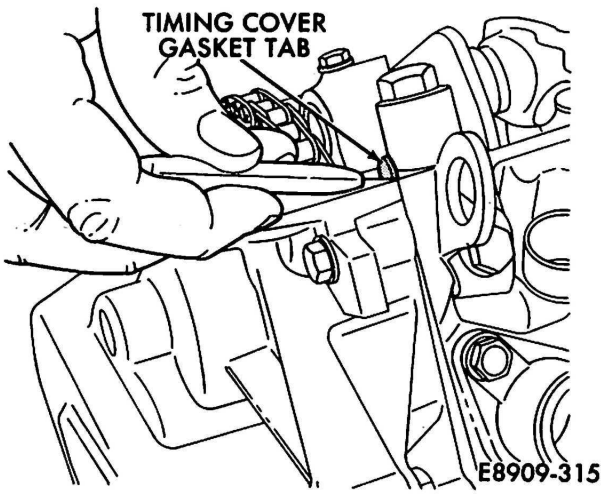


Fig. 10—Timing Cover Gasket Tab

(6) Install the crankshaft pulley. Apply Loctite 271 to the threads of the crankshaft pulley nut (Fig. 9). Tighten the nut to 180 N·m (133 ft-lbs) torque.

(7) Cut the timing cover gasket tabs flush with the head (Fig. 10). The tabs protrude above the front cover and cylinder head.

FRONT CRANKSHAFT OIL SEAL REPLACEMENT

If the front cover is off of the engine, use a socket to push the old seal out of the cover.

If the cover is attached to the engine, use a screwdriver (Fig. 11) and carefully pry the seal out of the cover taking care not to damage the seal locating bore.

Lightly oil the new seal and install it using Tool 6077 (Fig. 12).

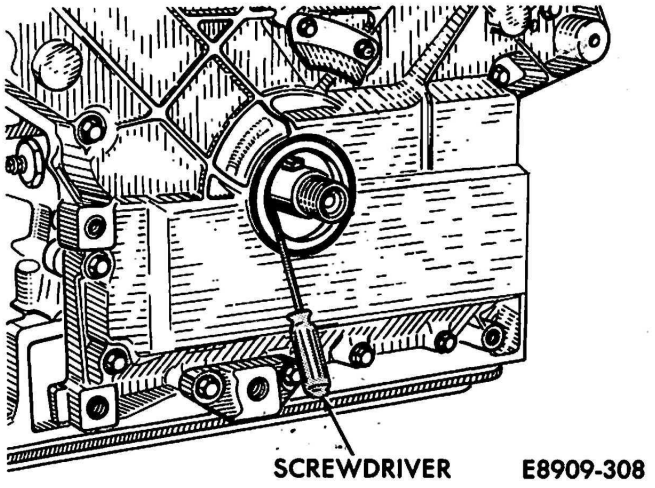


Fig. 11—Seal Removal using Screwdriver

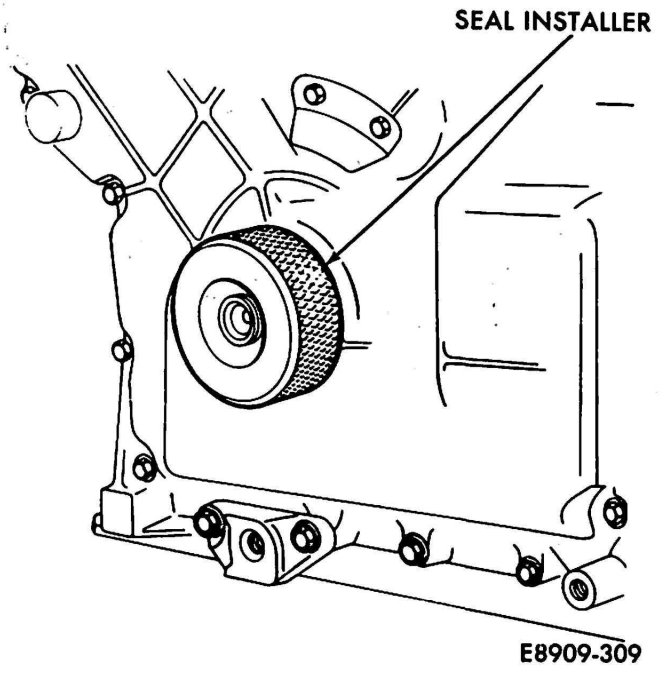


Fig. 12—Seal Installation using Tool 6077

DISTRIBUTOR CAP/ROTOR/DUST COVER

The distributor rotor is attached to the front of the distributor drive which is indexed to the left camshaft (Fig. 1). The distributor drive itself is a two piece assembly that is pinned together. The drive rides in an oil seal located in the engine timing cover behind the distributor housing. The engine timing cover must be removed to service the oil seal.

Removal

(1) Remove the distributor wires from the spark plugs.
(2) If necessary, remove distributor cap shield (Fig.2).
(3) Completely loosen distributor cap screws (Fig. 2).
(4) Remove mounting screws that attach the rotor to the distributor drive.
(5) Remove rotor (Fig. 3).
(6) Remove dust cover (Fig. 3).

Installation

(1) Install dust cover into the distributor housing (Fig. 4).
(2) Install rotor (Fig. 4).
(3) Tighten the rotor mounting bolts to 3 N·m (26 in-lbs) torque.
(4) Install distributor cap (Fig. 4).
(5) Tighten the distributor cap mounting bolts to 4 N·m (35 in-lbs) torque.

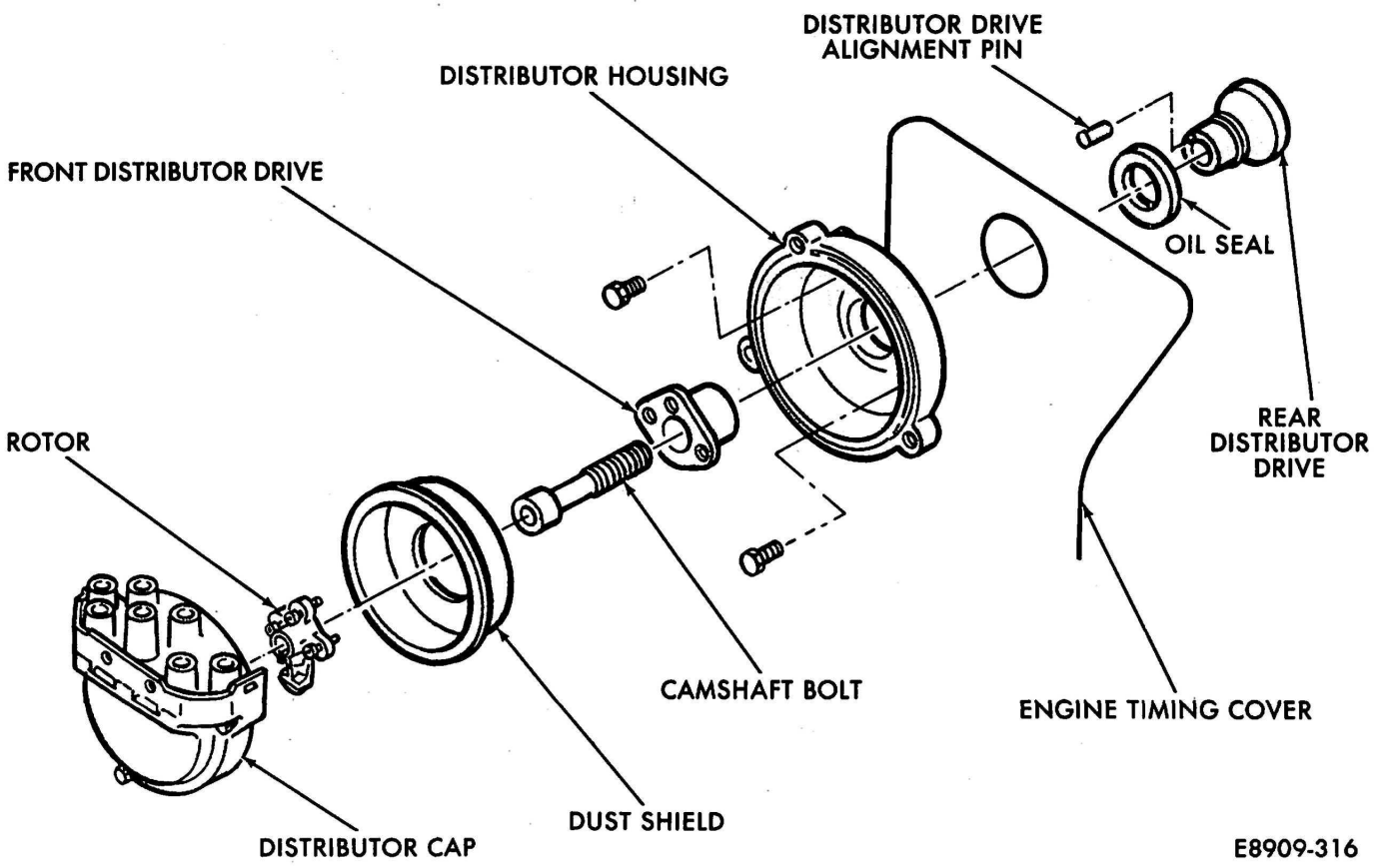


Fig. 1—Distributor Cap/Rotor/Dust Cover

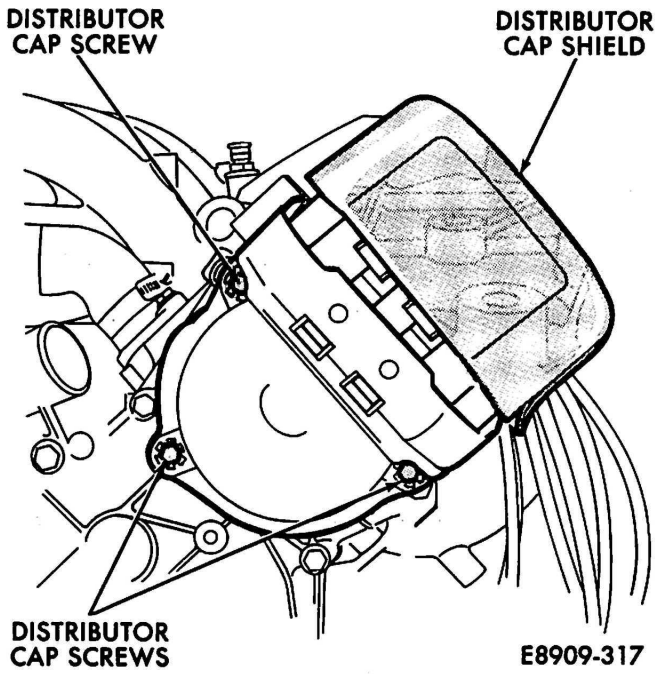


Fig. 2—Distributor Cap

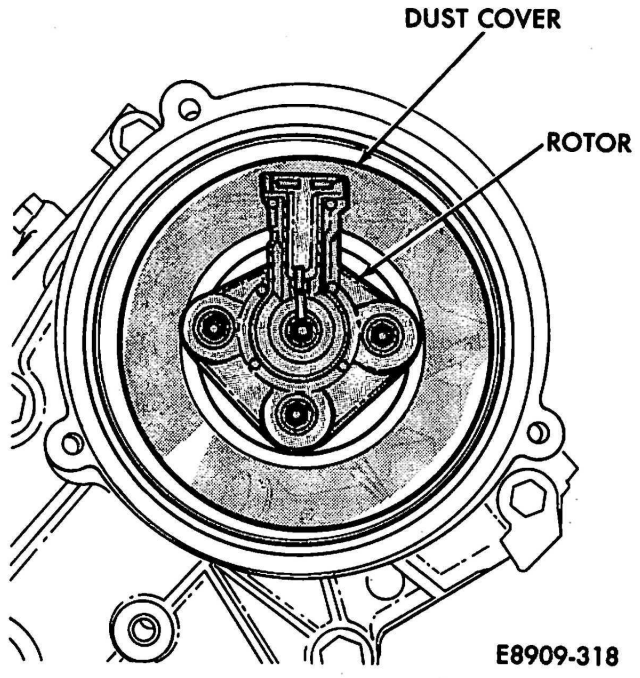


Fig. 3—Dust Cover/Rotor

DISTRIBUTOR DRIVE OIL SEAL REPLACEMENT

(1) The timing cover must be removed to replace the distributor drive seal.

(2) Separate the distributor drive; front and rear sections. It may be necessary to use a small drift punch and tap at the parting line to separate the two sections (Fig. 5).

(3) The distributor drive seal is located behind the distributor housing (Fig. 6).

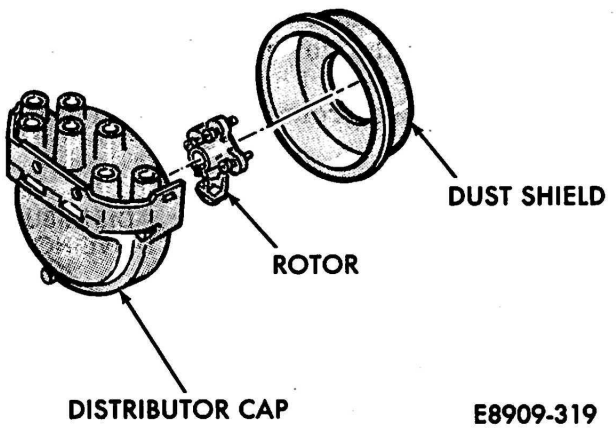


Fig. 4—Distributor Cap/Rotor/Dust Shield

(4) Remove the distributor housing mounting bolts and then remove the housing (Fig. 6).

(5) Use a socket to push the old seal out.

(6) Use special Tool 6126 to install the new seal flush with the cover (Fig. 7). When the distributor housing is reattached, the seal will be seated to the proper depth in the cover.

(7) Install the distributor housing.

(8) Lightly oil the seal lips.

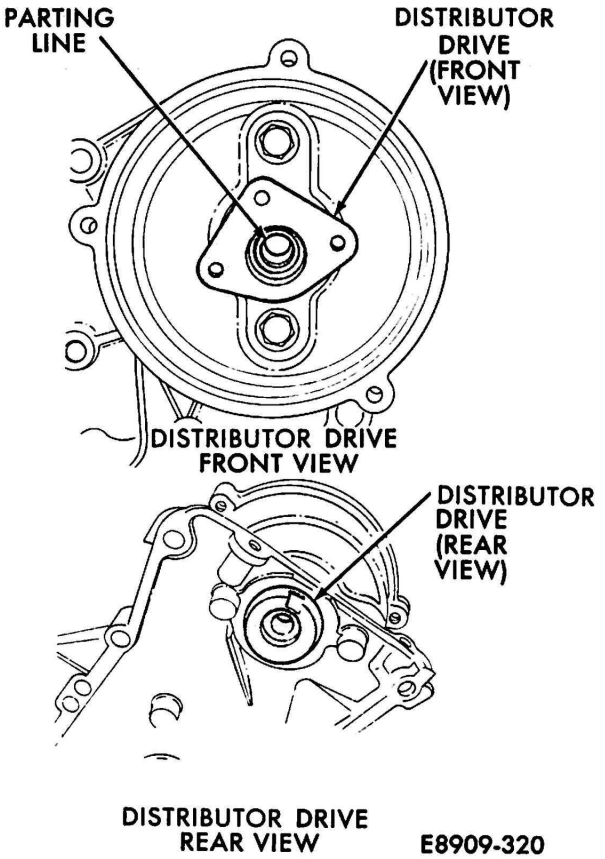


Fig. 5—Distributor Drive

(9) Install the distributor drive rear section through the back of the cover, past the seal and up into the distributor housing.

(10) Line up the dowel in the top of the rear section with the dowel hole in the bottom of the distributor drive front section and tap them together.

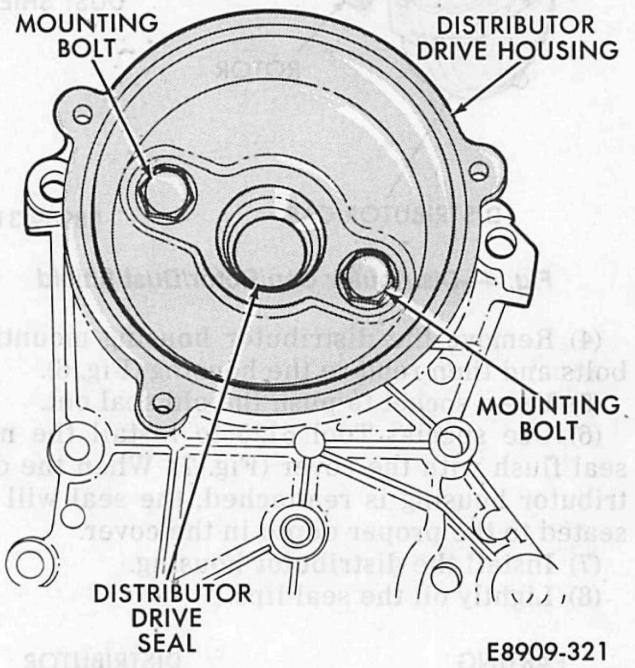


Fig. 6—Distributor Housing/Distributor Drive Seal

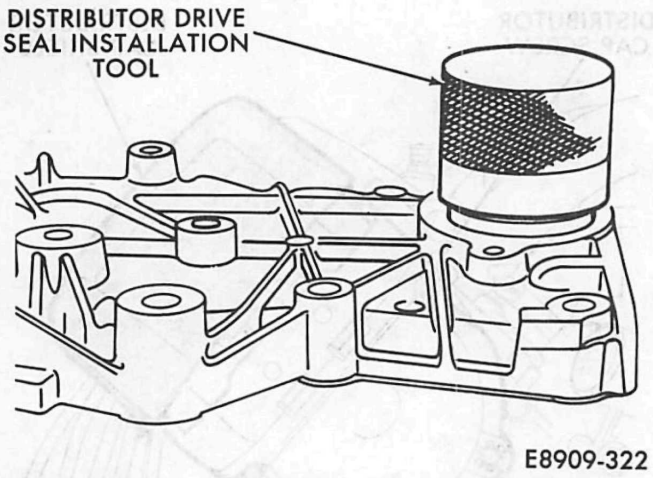


Fig. 7—Distributor Drive Seal Installation—Tool 6126

OIL PUMP

Removal

(1) Remove the timing cover.

(2) Rotate the crankshaft until crankshaft key is pointing up (Fig. 1).

(3) Remove oil pump socket mounting bolts (Fig. 1). Note that they have a thread lock on them.

(4) Clean the thread lock from the bolts.

(5) Remove chain sprocket and chain (Fig. 1).

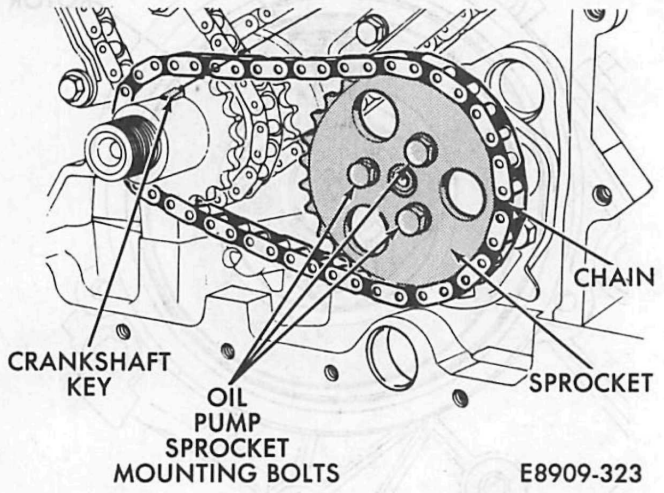


Fig. 1—Oil Pump Sprocket and Chain

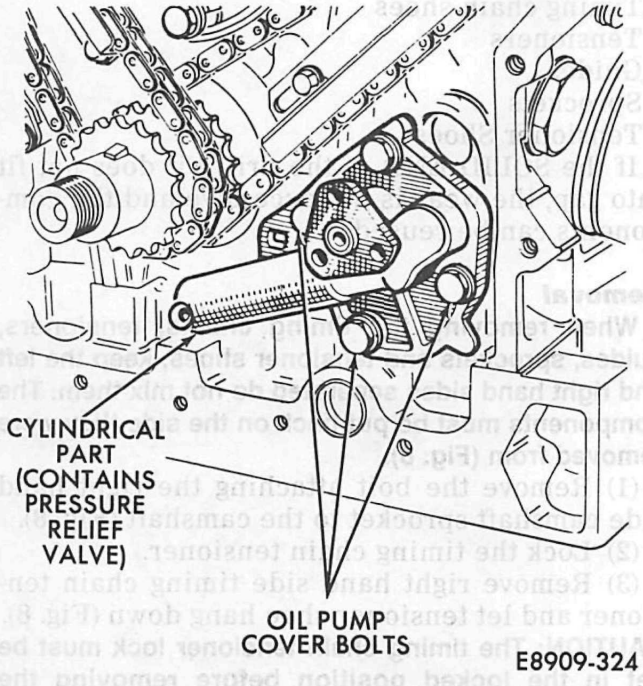


Fig. 2—Oil Pump Cover Bolts

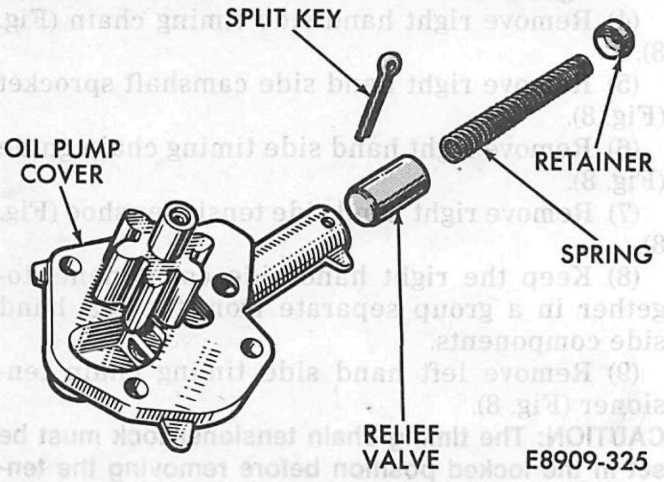


Fig. 3—Relief Valve Components

CAUTION: When removing the oil pump cover, do not strike the cylindrical part that contains the pressure relief valve (Fig. 2).

(6) Remove oil pump cover bolts (Fig. 2).

(7) Remove the oil pump cover.

(8) Remove the split key from the oil pump cover. Remove the retainer, the spring and the relief valve (Fig. 3). Check the condition of all parts. If any part shows excessive wear, the complete oil pump must be replaced.

Installation

(1) Coat with clean engine oil and install the relief valve, the spring and the retainer into the oil pump cover (Fig. 3). When installing the relief valve, the open end must face the spring.

(2) Install the split key (Fig. 3).

(3) Lubricate the driven gear idler shaft with clean engine oil.

(4) Install the driven gear over the idler shaft.

(5) Install the oil pump cover. Tighten the bolts to 12 N·m (9 ft-lbs) torque.

(6) Prime the oil pump by squirting oil through hole (A) below the oil filter connector (Fig. 4).

(7) Fill the oil filter with clean engine oil and install it on the engine.

(8) After the timing chains have been installed, install the oil pump sprocket and the chain. Coat the threads of the sprocket mounting bolts with Loctite 271 and tighten the bolts to 6 N· (53 in-lbs) torque.

TIMING CHAINS/TENSIONERS/SPROCKETS

Inspection

Check the timing chain and sprocket for wear. If either side has excessive wear, replace the timing chains, sprockets guide shoes and tensions for BOTH sides.

Remove the cylinder head cover.

Pull on the top of the timing chains. This will produce a gap between the bottom of the timing chain and the bottom of the area between the two sprocket teeth (Fig. 5).

A maximum clearance (gap) of 1.7 mm (.067 in) between the timing chain and sprocket must not be exceeded. A gap of 1.7 mm (.067 in) corresponds to a travel of 22 mm (.866 in) by the timing chain tensioner plunger (Fig. 6).

Use the SOLID END of a number 51 drill bit (1.7 mm-.067in. diameter) to gauge the size of gap (Fig. 7).

If the SOLID END of the drill bit fits into the gap between the timing chain and the two sprocket teeth, then the following components MUST be replaced:

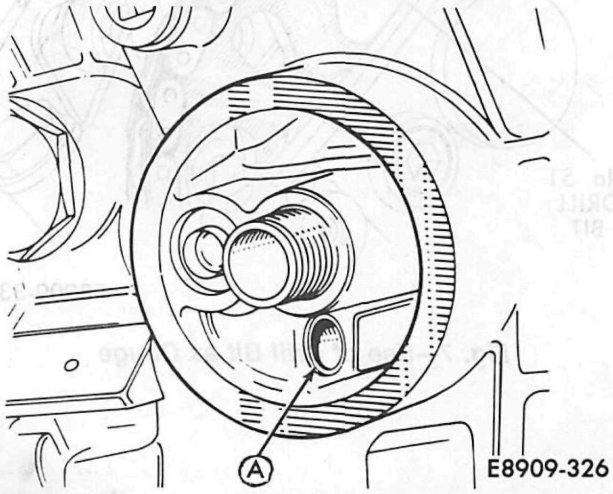


Fig. 4—Prime Oil Pump Through Hole "A"

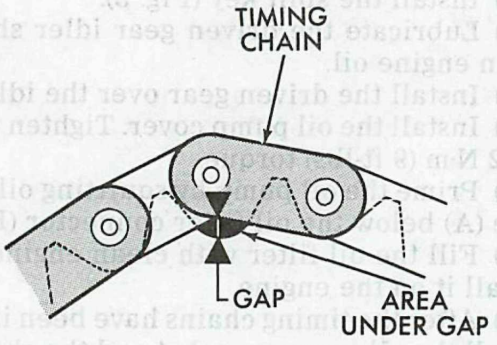


Fig. 5—Timing Chain Gap

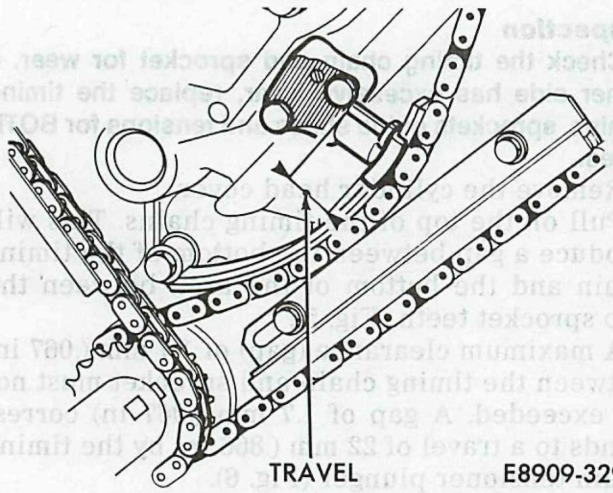


Fig. 6—Travel of Tensioner Plunger

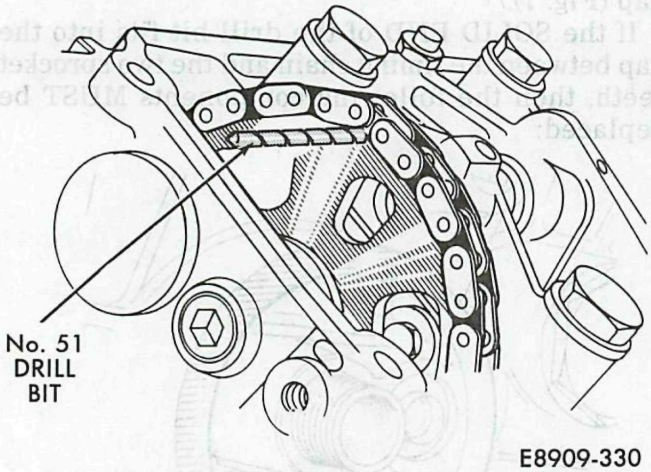


Fig. 7—Use of Drill Bit as Gauge

- Timing chain shoes
- Tensioners
- Guides
- Sprockets
- Tensioner Shoes

If the SOLID END of the drill bit does not fit into gap, the wear is not excessive and the components can be reused.

Removal

When removing the timing chains, tensioners, guides, sprockets and tensioner shoes, keep the left and right hand sides separated do not mix them. The components must be put back on the side they were removed from (Fig. 8).

(1) Remove the bolt attaching the right hand side camshaft sprocket to the camshaft (Fig. 8).

(2) Lock the timing chain tensioner.

(3) Remove right hand side timing chain tensioner and let tensioner shoe hang down (Fig. 8).

CAUTION: The timing chain tensioner lock must be set in the locked position before removing the tensioner. To lock the tensioner, rotate the slotted lock finger counterclockwise with a thin screwdriver.

(4) Remove right hand side timing chain (Fig. 8).

(5) Remove right hand side camshaft sprocket (Fig. 8).

(6) Remove right hand side timing chain guide (Fig. 8).

(7) Remove right hand side tensioner shoe (Fig. 8).

(8) Keep the right hand side components together in a group separate from the left hand side components.

(9) Remove left hand side timing chain tensioner (Fig. 8).

CAUTION: The timing chain tensioner lock must be set in the locked position before removing the tensioner. To lock the tensioner, rotate the slotted lock finger counterclockwise with a thin screwdriver.

(10) Remove left hand side timing chain (Fig. 8).

(11) Remove left hand side camshaft sprocket (Fig. 8).

(12) Remove left hand side timing chain guide (Fig. 8).

(13) Remove left hand side tensioner shoe (Fig. 8).

(14) Remove tensioner filters (Fig. 9).

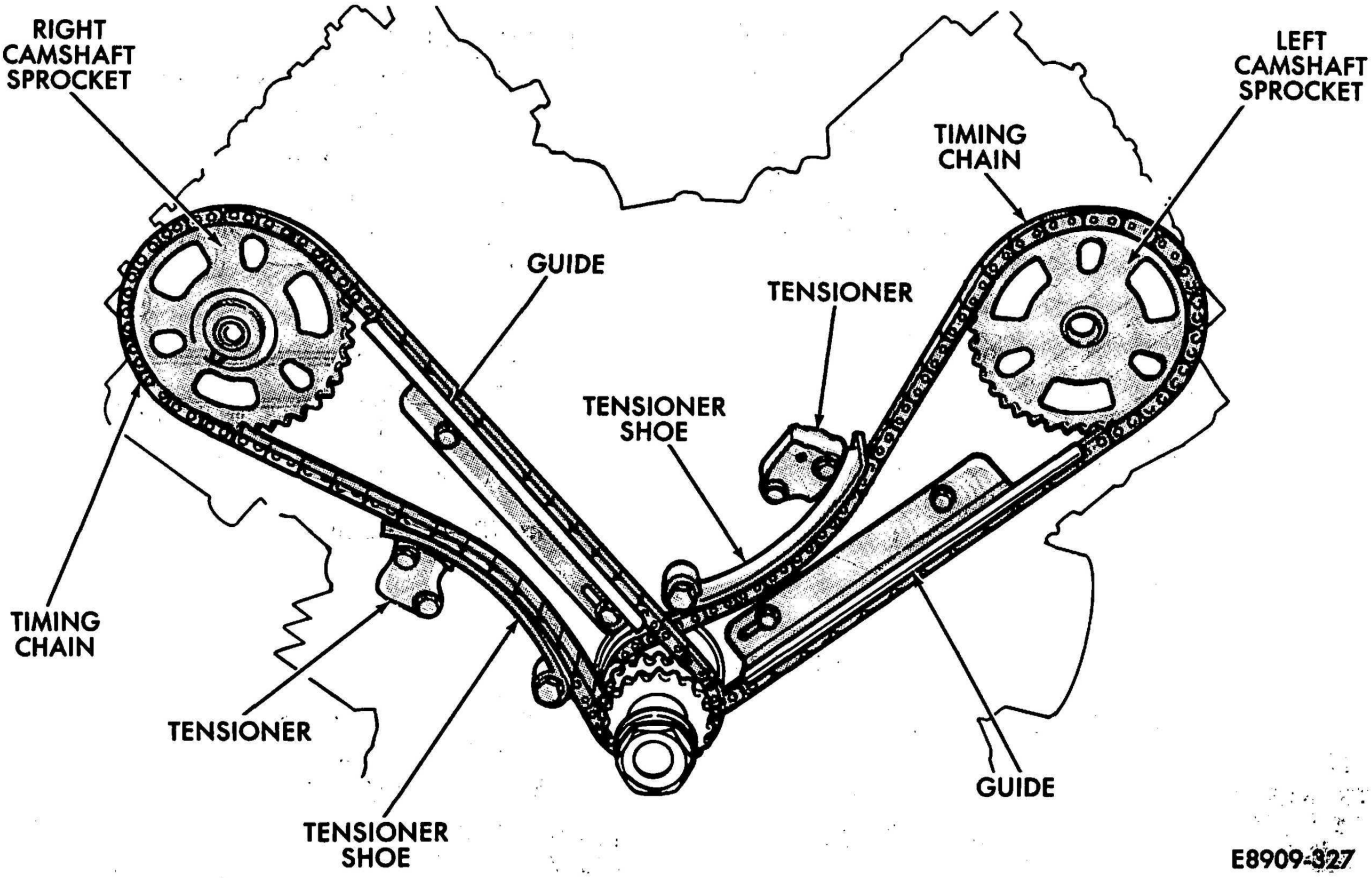


Fig. 8—Timing Chains/Sprockets/Tensioners

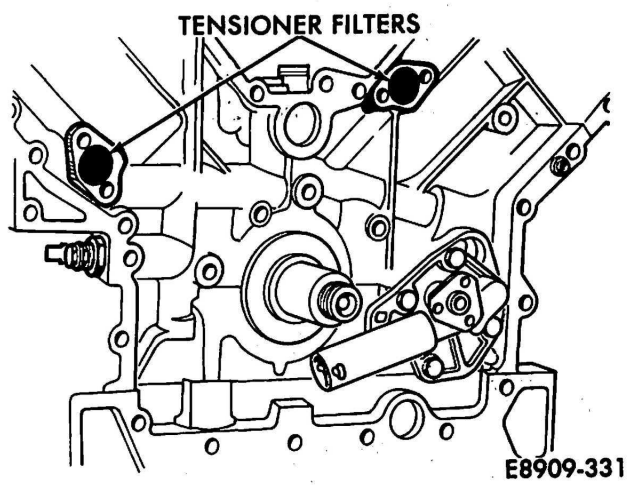


Fig. 9—Tensioner Filters

Installation

The timing chains are identical and when NEW can be used with either camshaft sprocket. Used chains MUST be installed on the same side they were removed from.

The camshaft sprockets are not identical. The right camshaft sprocket has a spacer attached to it. The left camshaft sprocket does not have a spacer.

The timing chain tensioners, shoes and guides are identical and when NEW can be used on either timing chain. Used tensioners, shoes and guides MUST be installed on the same side they were removed from.

When installing the timing chains and sprockets, the left bank of the engine must be timed first.

(1) Install the chain guides (Fig. 10). Tighten the bolts to 6 N·m (53 in-lbs) torque.

(2) Install the tensioner shoes (Fig. 10). Tighten the bolts to 12 N·m (9 ft-lbs) torque.

(3) Turn the crankshaft so that keyway points straight up (Fig. 11).

(4) Turn the left camshaft until slot in the front is positioned as shown in Fig. 12.

(5) Turn the right chamshaft until slot in the front is positioned as shown in Fig. 13.

(6) Install the cleaned tension filters (Fig. 9).

(7) Turn the crankshaft in a clockwise direction until the crankshaft keyway is aligned with the centerline of the left cylinder bank (Fig. 14).

Left Timing Chain

The crankshaft has three separate sprockets. One sprocket is for the left timing chain, one is for the right timing chain and one is for the oil pump chain.

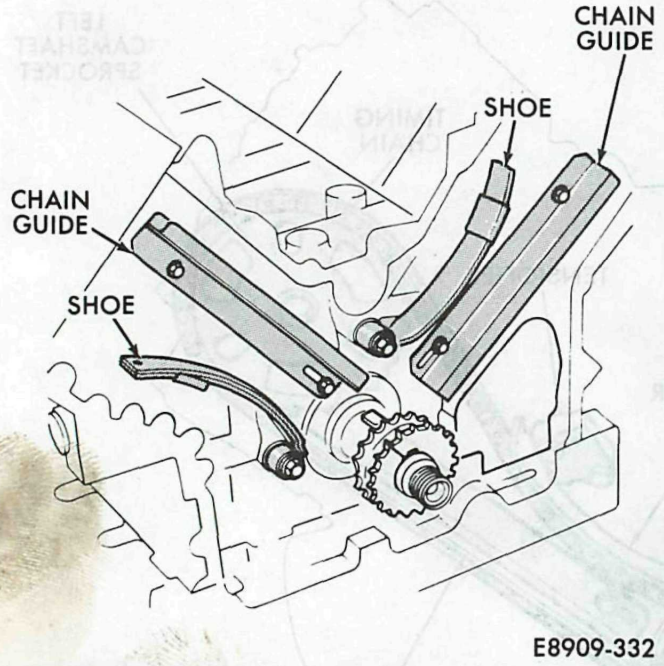


Fig. 10—Chain Guides/Tensioner Shoes

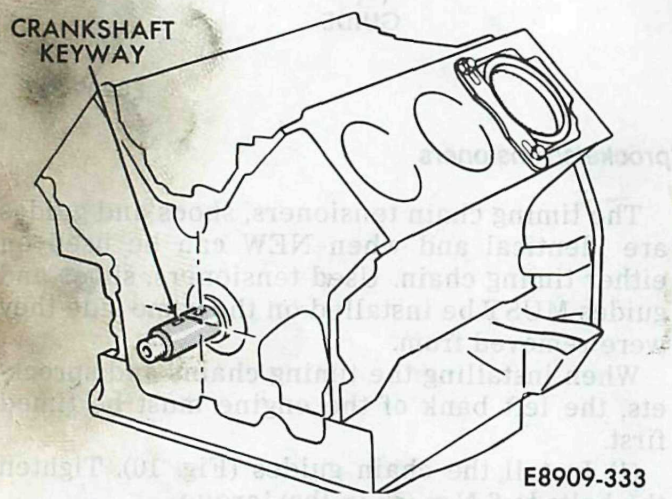


Fig. 11—Crankshaft Keyway Position

(8) The left camshaft sprocket does not have a built-in spacer. Install the left timing chain so that the unpainted link between the two painted links is aligned with the stamped timing mark on the left camshaft sprocket (Fig. 15).

(9) The timing mark is located on the middle (or second) sprocket which is for the RIGHT timing chain. Install the left timing chain by positioning the single painted link of the LEFT timing chain onto the tooth of the rear sprocket. That tooth is directly behind the tooth of the middle sprocket that has the timing mark (Fig. 16).

CAUTION: The timing chain tensioner lock should not be removed. The lock is held in place by a spring that pushes a steel ball against lock finger (Fig. 17) If

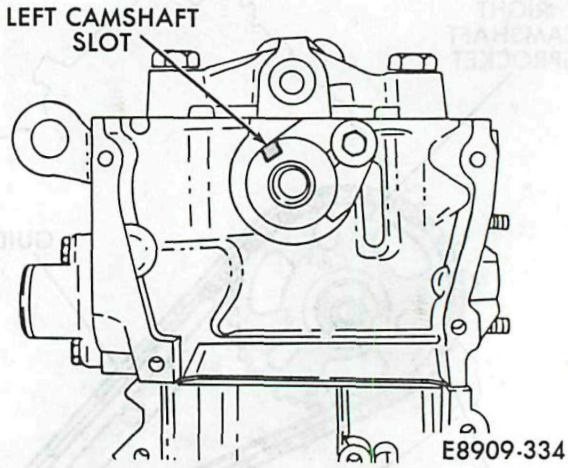


Fig. 12—Left Camshaft Slot Position

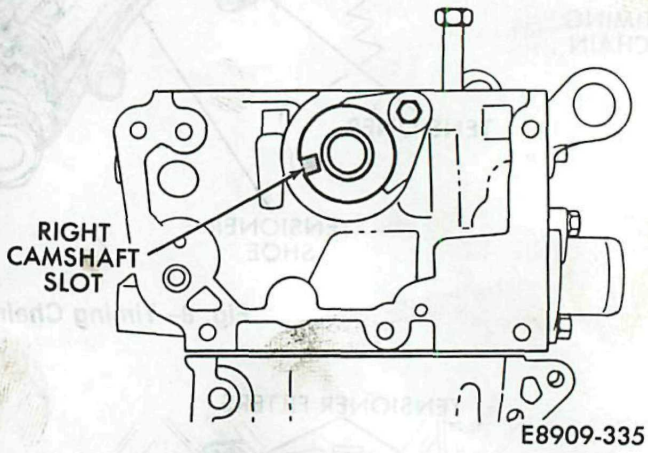


Fig. 13—Right Camshaft Slot Position

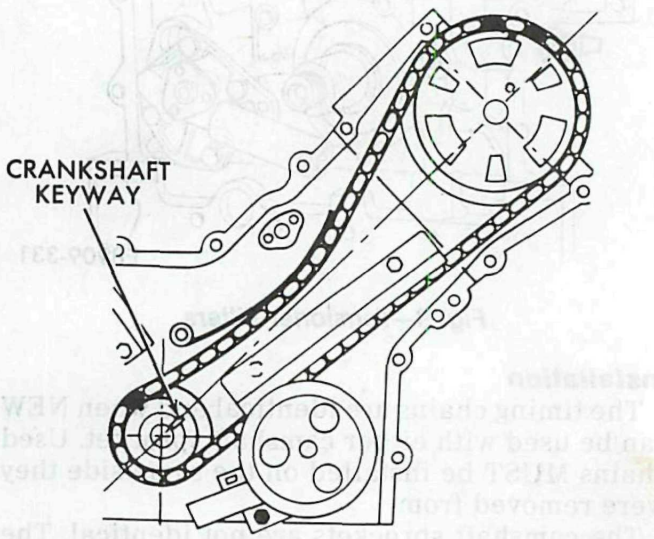


Fig. 14—Crankshaft Keyway Alignment

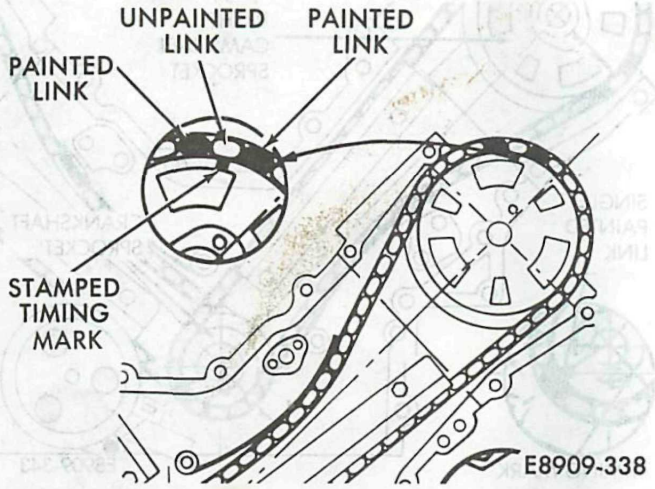


Fig. 15—Left Camshaft Sprocket to Timing Chain Alignment

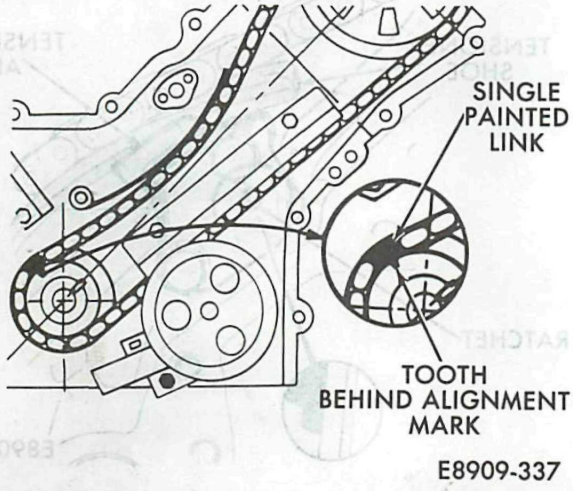


Fig. 16—Crankshaft Sprocket to Chain Alignment

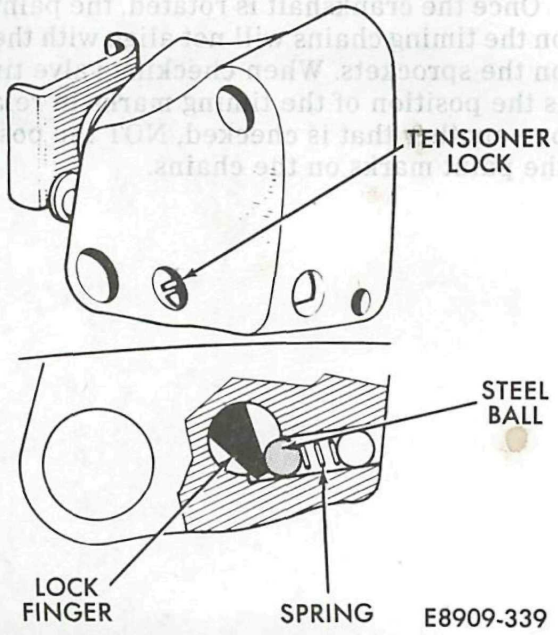


Fig. 17—Tensioner Lock

the lock is removed accidentally, replace the tensioner assembly because there is no way of checking the position of the lock finger in relation to the steel ball.

(10) To install the left timing chain tensioner use a thin blade screwdriver to turn the ratchet counterclockwise. Then push the tensioner arm in. Position the tensioner over the filter and the tensioner shoe into the arm (Fig. 18).

(11) Tighten the mounting bolts to 6 N·m (53 in-lbs) torque.

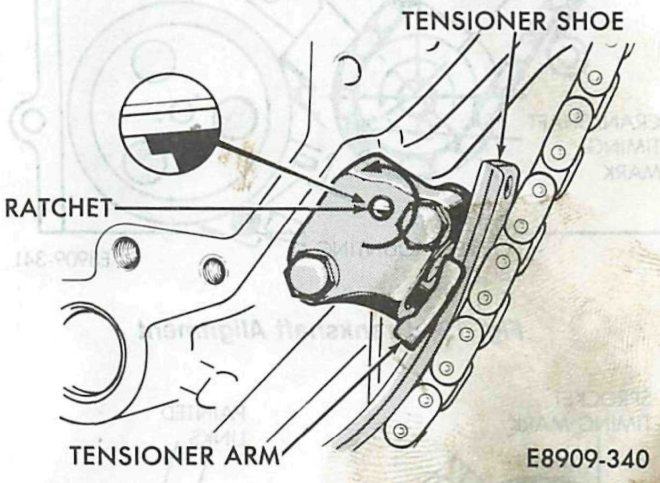


Fig. 18—Left Timing Chain Tensioner

Right Timing Chain

(12) Rotate the crankshaft approximately 150° until the timing mark on the crankshaft middle sprocket is aligned with the lower oil pump cover mounting bolt (Fig. 19).

(13) The right camshaft sprocket has a built-in spacer. Install the right timing chain so that the unpainted link between the two painted links is aligned with the stamped timing mark on the right camshaft sprocket (Fig. 20).

(14) Single painted link on the bottom of the timing chain is aligned with timing mark on the middle sprocket (Fig. 21).

CAUTION: The timing chain tensioner lock should not be removed. The lock is held in place by a spring that pushes a steel ball against lock finger (Fig. 17). If the lock is removed accidentally, replace the tensioner assembly because there is no way of checking the position of the lock finger in relation to the steel ball.

(15) To install the left timing chain tensioner use a thin blade screwdriver to turn the ratchet counterclockwise. Then push the tensioner arm in. Position the tensioner over the filter and the tensioner shoe into the arm (Fig. 22).

(16) Tighten the mounting bolts to 6 N·m (53 in-lbs) torque.

(17) Install the right camshaft sprocket bolt and tighten the bolt to 80 N·m (59 ft-lbs) torque.

(18) Push both tensioner shoes in to release the ratchet of the tensioner from the locked position and then let the shoes out (Fig. 23).

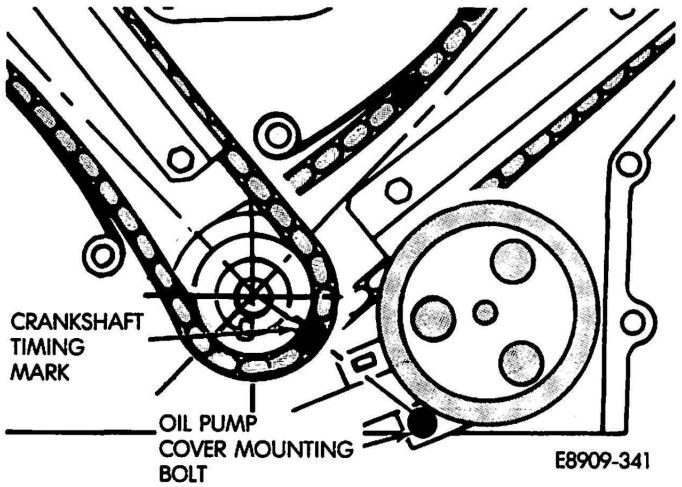


Fig. 19—Crankshaft Alignment

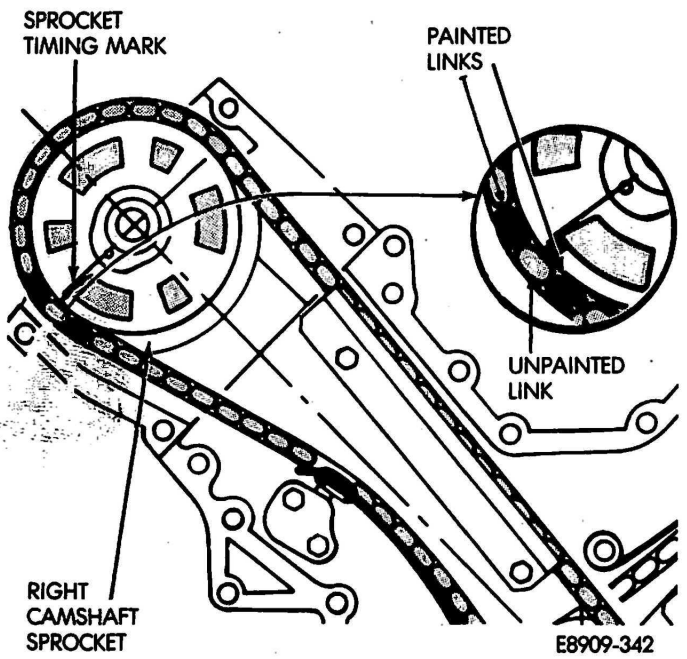


Fig. 20—Right Camshaft Sprocket to Timing Chain Alignment

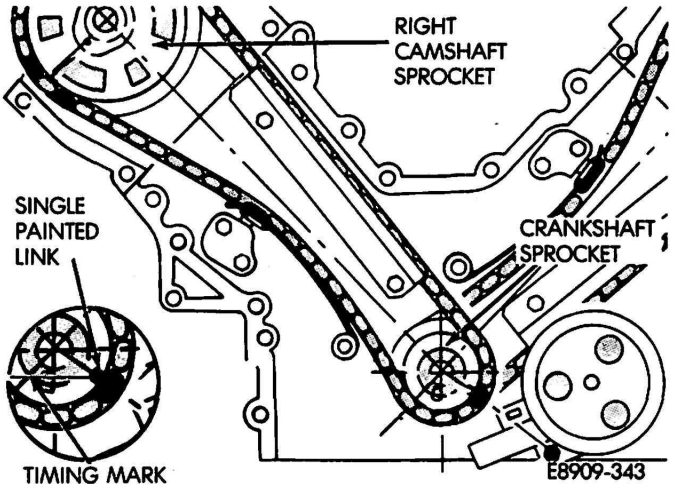


Fig. 21—Crankshaft to Timing Chain Alignment

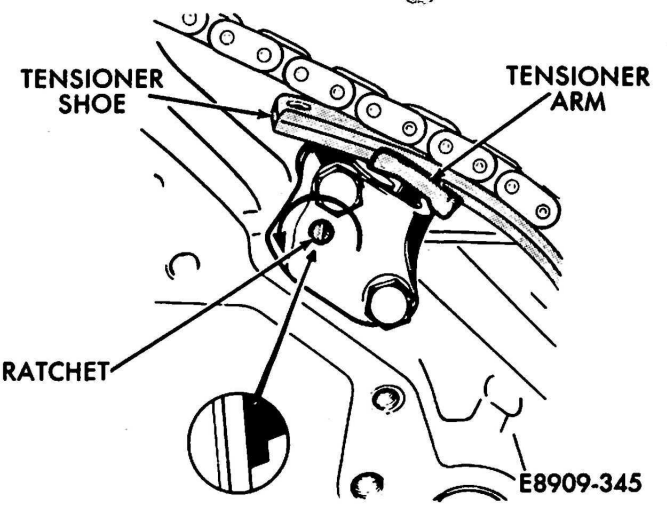


Fig. 22—Right Timing Chain Tensioner

Valve Timing Check

Once the crankshaft is rotated, the paint marks on the timing chains will not align with the marks on the sprockets. When checking valve timing, it is the position of the timing marks in relation to one another that is checked, NOT the position of the paint marks on the chains.

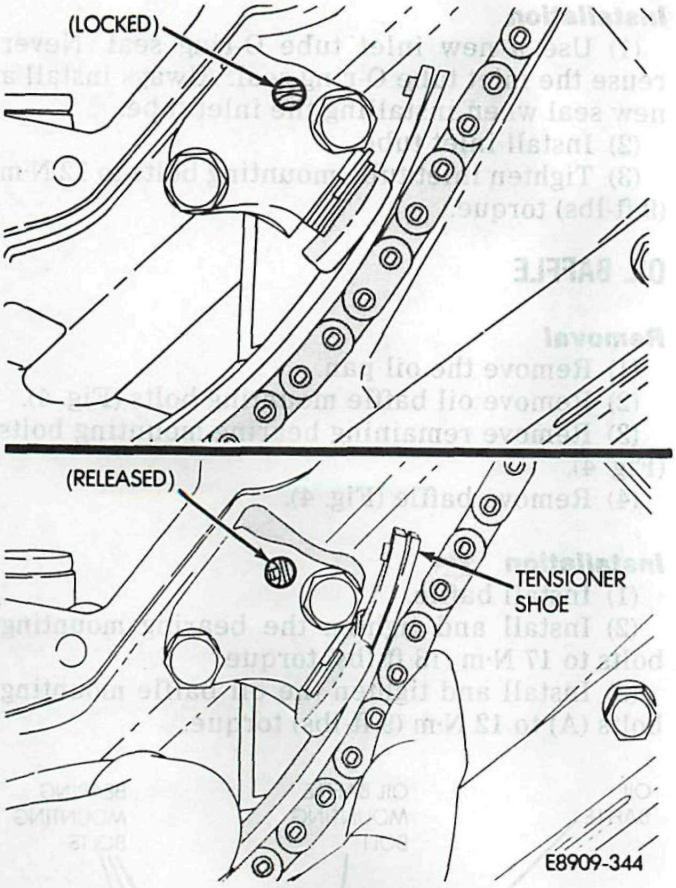


Fig. 23—Tensioner Ratchet

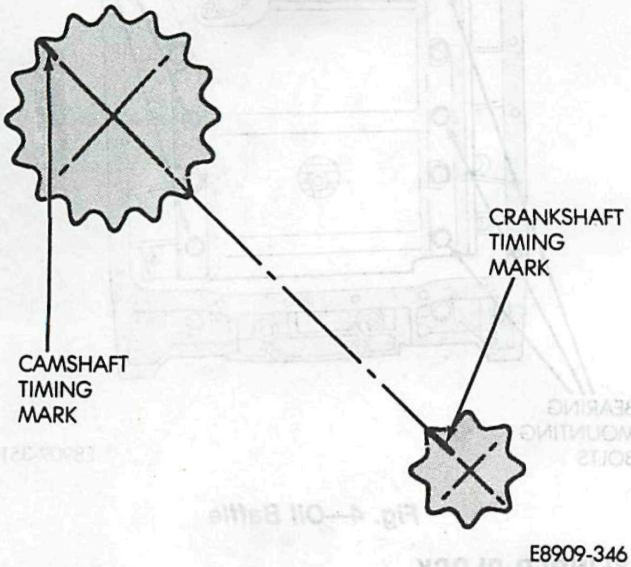


Fig. 24—Right Camshaft/Crankshaft Timing Mark Alignment

(1) Rotate the crankshaft 180°. Check that the right camshaft sprocket timing mark and the crankshaft timing are aligned as shown in (Fig. 24).

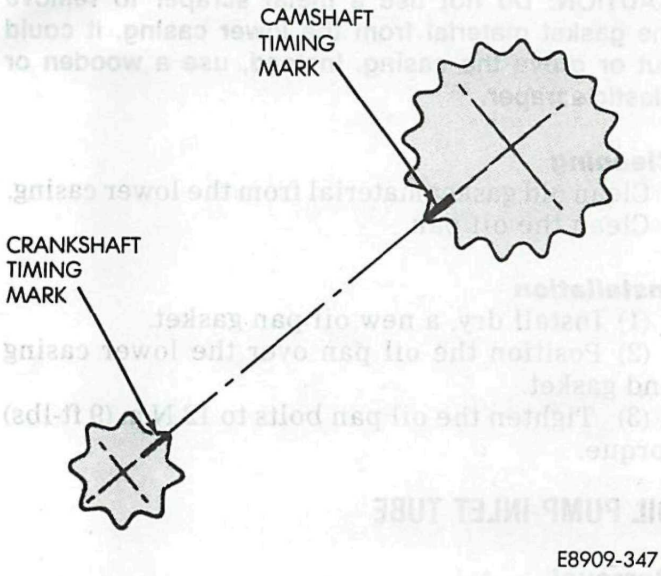


Fig. 25—Left Camshaft/Crankshaft Timing Mark Alignment

(2) Rotate the crankshaft another 90°. The left camshaft sprocket timing mark and the crankshaft sprocket timing mark should be aligned as shown in (Fig. 25).

OIL PAN

Removal

(1) Drain the engine oil.

(2) If the cylinder head is removed, install liner clamps acroos the 4 center head bolts to keep the liners in place.

(3) Rotate the engine on the engine stand until the oil pan points up.

(4) Remove the oil pan bolts and washers (Fig. 1).

(5) Remove oil pan (Fig. 1).

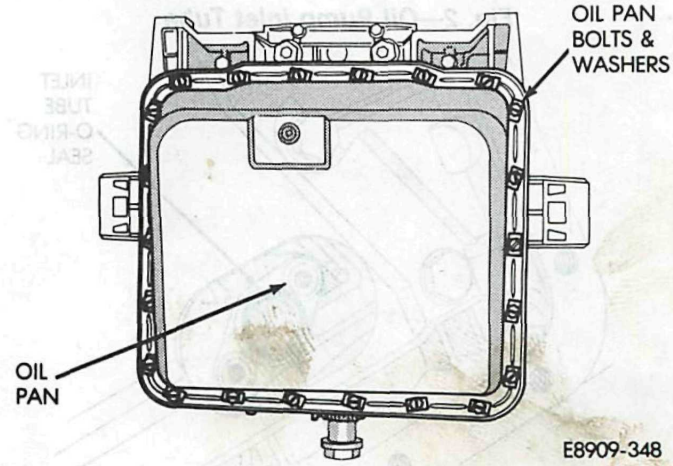


Fig. 1—Oil Pan

CAUTION: Do not use a metal scraper to remove the gasket material from the lower casing, it could cut or grove the casing. Instead, use a wooden or plastic scraper.

Cleaning

Clean old gasket material from the lower casing.
Clean the oil pan.

Installation

(1) Install dry, a new oil pan gasket.
(2) Position the oil pan over the lower casing and gasket.
(3) Tighten the oil pan bolts to 12 N·m (9 ft-lbs) torque.

OIL PUMP INLET TUBE

Removal

(1) Remove the oil pump inlet tube mounting bolts (Fig. 2).
(2) Remove the inlet tube (Fig. 2).
(3) Remove O-ring seal (Fig. 3). Discard the inlet tube O-ring seal.

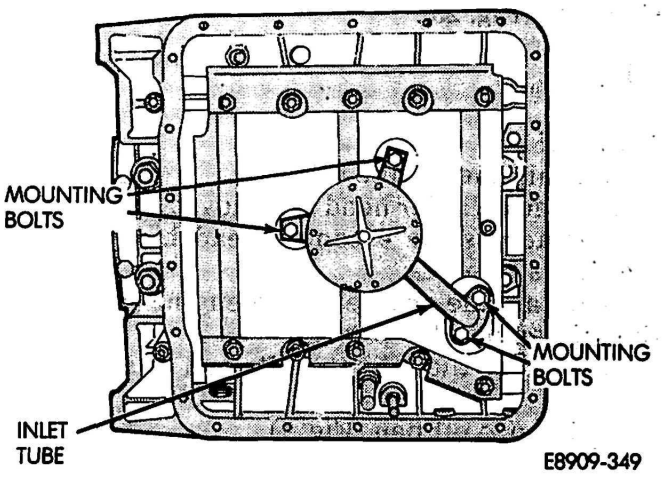


Fig. 2—Oil Pump Inlet Tube

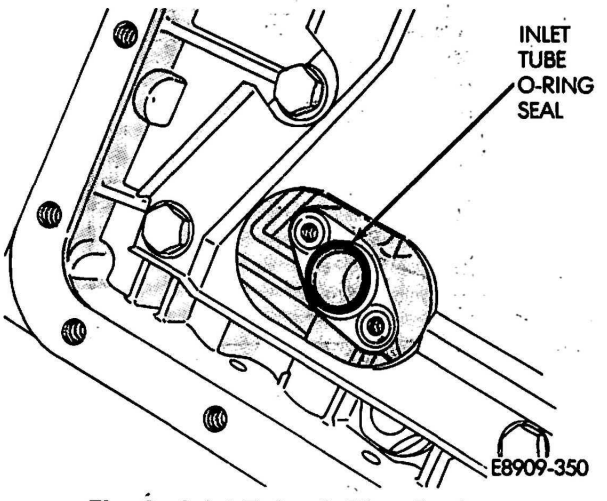


Fig. 3—Inlet Tube O-Ring Seal

Installation

(1) Use a new inlet tube O-ring seal. Never reuse the inlet tube O-ring seal. Always install a new seal when installing the inlet tube.
(2) Install inlet tube.
(3) Tighten inlet tube mounting bolts to 12 N·m (9 ft-lbs) torque.

OIL BAFFLE

Removal

(1) Remove the oil pan.
(2) Remove oil baffle mounting bolts (Fig. 4).
(3) Remove remaining bearing mounting bolts (Fig. 4).
(4) Remove baffle (Fig. 4).

Installation

(1) Install baffle.
(2) Install and tighten the bearing mounting bolts to 17 N·m (13 ft-lbs) torque.
(3) Install and tighten the oil baffle mounting bolts (A) to 12 N·m (9 ft-lbs) torque.

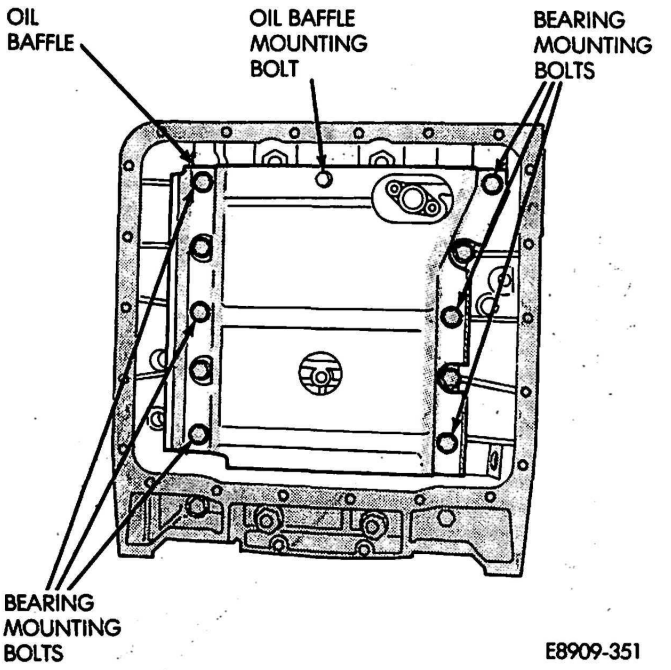


Fig. 4—Oil Baffle

CYLINDER BLOCK

Disassembly

(1) Remove the oil pan, inlet tube and baffle.
(2) Remove the bearing mounting bolts and the lower casing to crankshaft rear seal housing bolts (Fig. 5).
(3) Remove the nuts from the main bearing studs (Fig. 5).

(4) Using a soft rubber hammer, tap the under side of the engine mounts to loosen the lower casing (Fig. 5).

(5) Remove the lower casing.

(6) Remove and discard the oil galley O-ring seal. Never reuse the oil galley O-ring seal between the lower casing and the cylinder block.

CAUTION: When cleaning the gasket surfaces use a gasket remover to soften the old gasket material. Also, to avoid damage to the mating surfaces, do not use a metal scraper. Instead use a plastic or wooden scraper.

(7) When cleaning, ensure that foreign material does not enter the oil galley hole in the cylinder block (Fig. 6).

(8) Install clamps (Tool 6071) over the front and rear main bearing caps (Fig. 7). Use four lower casing nuts to hold the clamps in position.

(9) Turn the engine over on the engine stand and install liner clamps (Tool 7315) to hold the piston-liner assembly in place (Fig. 8).

(10) Turn the engine over on the engine stand.

(11) If the piston-liner assemblies will be reused, reference the piston to cylinder liner to cylinder block positions using a grease pencil.

(12) Mark each connecting rod and cap with the cylinder number on the side that faces out so that the caps can be installed with the proper connecting rods (Fig. 9). Connecting rod caps cannot be interchanged.

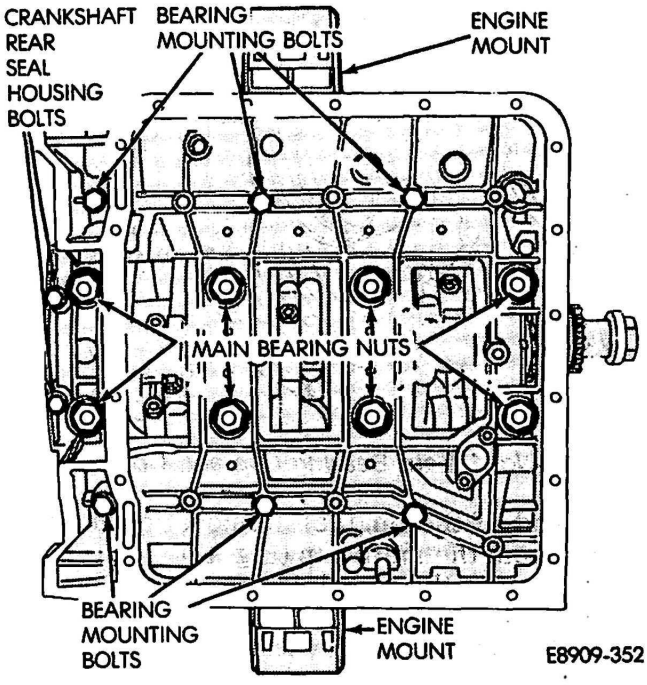


Fig. 5—Lower Casing

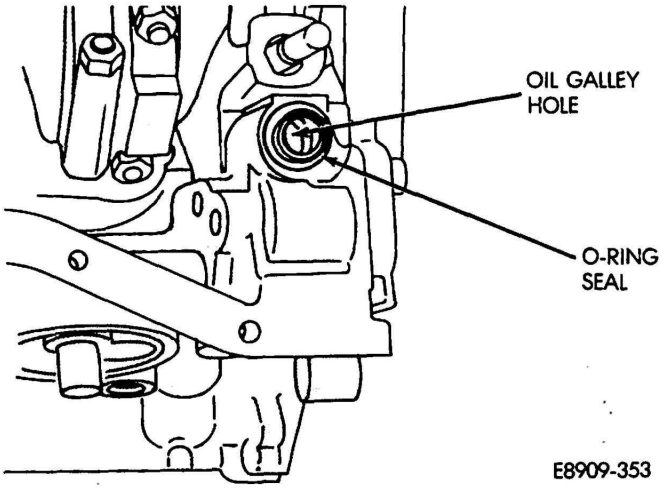


Fig. 6—Oil Galley Hole

(13) Loosen all connecting rod nuts. When loosening the connecting rod nuts, loosen the nuts of both connecting rods at each journal before removing either one of the connecting rod-piston-liner assembly. It will be necessary to rotate the crankshaft to provide access to all of the connecting rod nuts.

CAUTION: When removing the piston-liner, care must be taken so that the connecting rod bolts do not nick the crankshaft journal. Make insulators (Fig. 10) out of the rubber hose to fit over the connecting rod bolts once the cap is removed. Then remove the piston-liner assembly.

(14) For each piston-liner assembly, turn the crankshaft until the connecting rod cap is at the bottom of its travel (piston at the bottom of the liner).

(15) Remove the liner clamp(s) holding the liners in place.

(16) Have an assistant hold the liner in place.

(17) Remove the connecting rod nuts and cap.

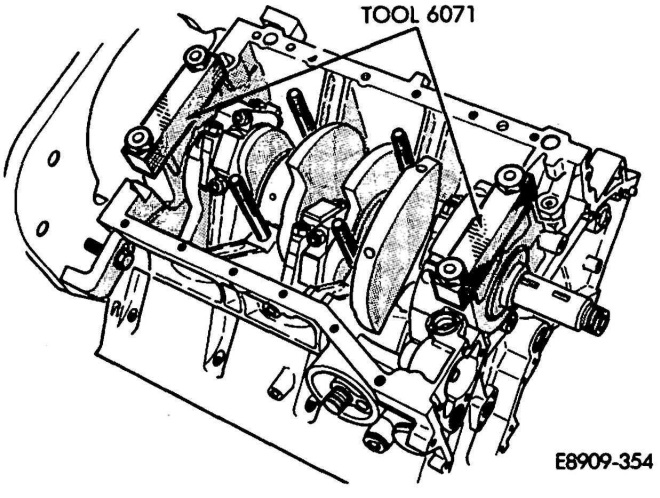


Fig. 7—Main Bearing Cap Clamps

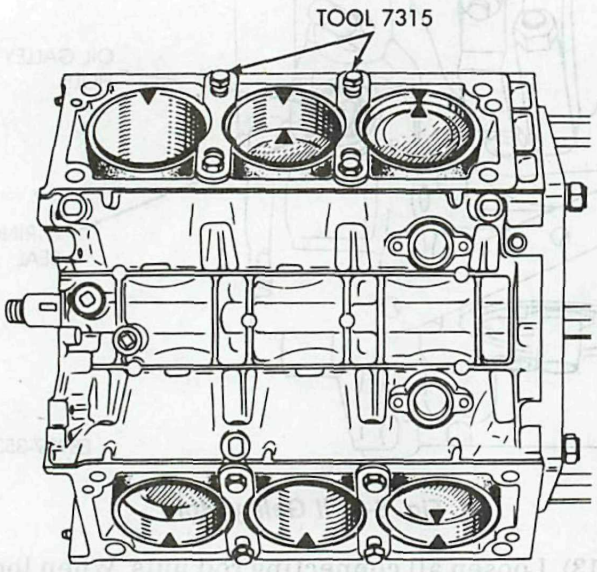


Fig. 8—Cylinder Liner Clamps

(18) Install rubber insulators over the connecting rod bolts.

(19) Remove the piston-liner assembly.

(20) Repeat the procedure on all other assemblies that are to be removed.

(21) Remove and discard liner seal.

(22) Remove the piston-connecting rod assembly from the bottom of the liner.

(23) Remove the oil pump from the front of the engine.

(24) Remove the clamps from the front and rear main bearing caps.

(25) Remove number one main bearing cap (flywheel end of the engine). Remove lower thrust washer from the main cap (Fig. 11).

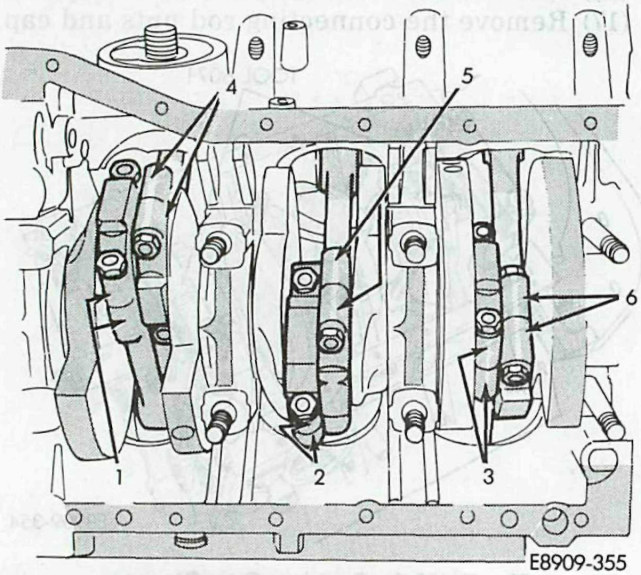


Fig. 9—Marking Connecting Rod and Caps

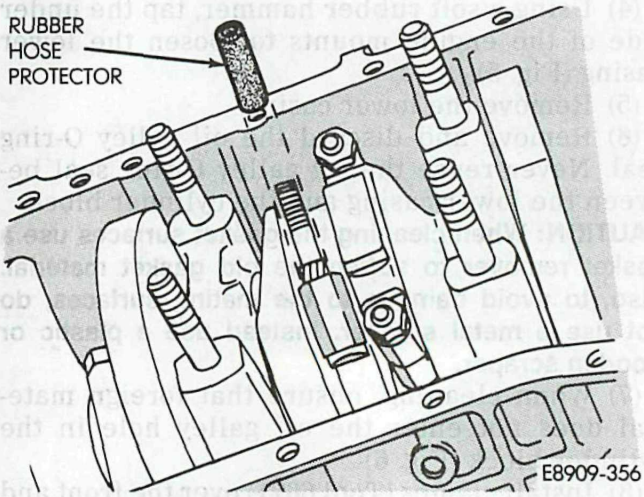


Fig. 10—Rubber Hose Protector

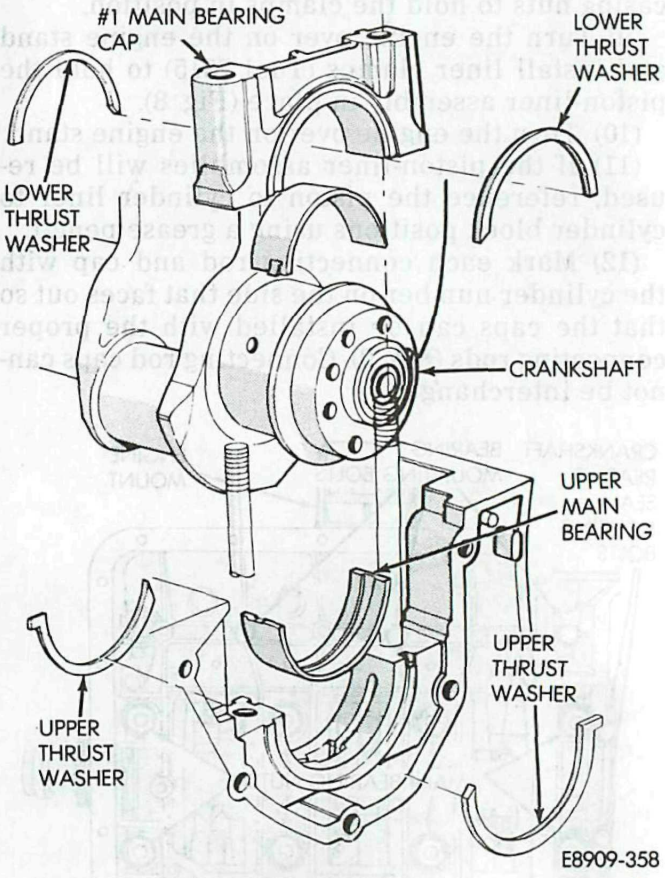


Fig. 11—No. 1 Main Bearing Cap and Components

(26) Remove the remaining main bearing caps.

(27) Lift the crankshaft out of the engine.

(28) Remove upper thrust washers (Fig. 11).

(29) Remove upper main bearing shells (Fig. 12). When removing the upper main bearing shells, mark the bearing number (1, 2, 3 and 4) on the back of the shell and keep it with the accompanying main bearing cap and lower bearing shell.

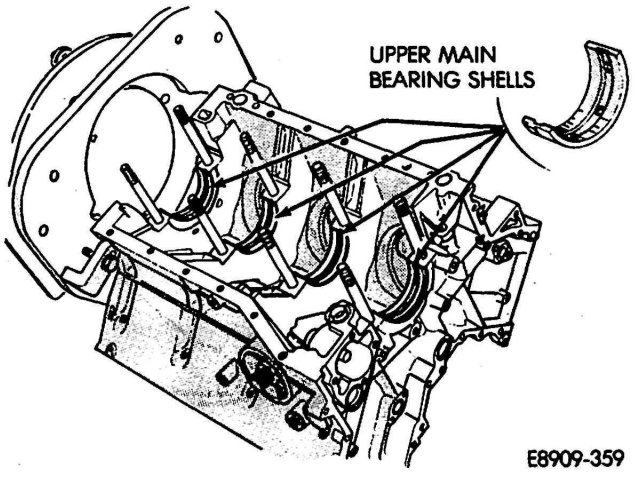


Fig. 12—Upper Main Bearing Shells

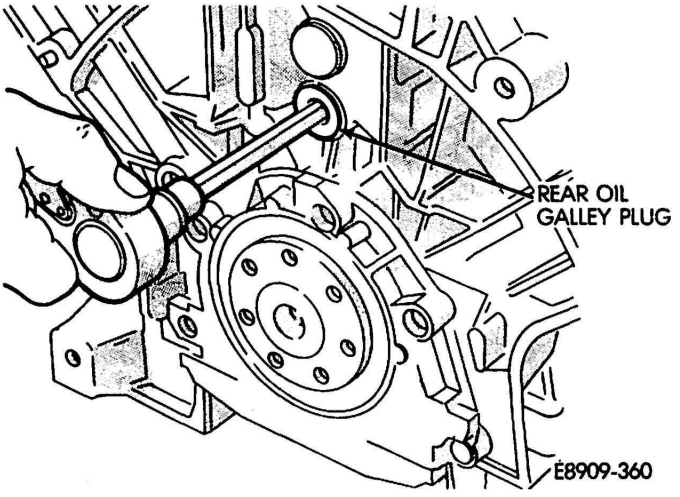


Fig. 13—Rear Oil Galley Plug

Cleaning

(1) Clean the cylinder liner seat. Remove all deposits from the seat and from the water jacket walls of the cylinder liner.

(2) When cleaning the cylinder block, remove the oil galley plug at the rear of the block (Fig. 13).

(3) Remove oil galley plug on the top of the block (Fig. 14).

(4) Remove oil galley plug on the right-hand side of the block (Fig. 15).

(5) Remove oil pressure sender (Fig. 15).

(6) Spray compressed air into all oil galley passages to ensure they are clear of blockage. Refer to the General Information Section—Lubrication System.

(7) Use a gasket removal compound to soften the old gasket material. Use a wooden or plastic scraper to remove the old gasket.

(8) Use fine grade 3M® Scotch Brite or equivalent to remove any small amounts of gasket material.

(9) Clean the oil passages in the crankshaft with a brush.

Inspection

Connecting Rods

The connecting rods are balanced assemblies with bearing inserts at the crankshaft journal end.

A squirt hole in the crankshaft end of the connecting rod provides lubrication for the cylinder walls and piston pins, the squirt hole faces the cylinder on the other bank directly across from it when the connecting rod is installed correctly.

Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment. Replace misaligned, bent or twisted rods.

Connecting Rod Bearings

Check the connecting rod bearing for scoring, flaking, scratches and excessive or abnormal wear patterns. The upper (thrust) bearing shell will have a larger wear pattern than the lower shell. If the bearings are scored, scratched or grooved, check the crankshaft connecting rod journal for scratches and nicks. Also check the oil passage from the main journal to the connecting rod journal for blockage. If the bearings are reused, they must be installed in the original position.

Rod Bearings

Check for an abnormal contact area (Fig. 16). This is caused by the locking tabs not fully seated or by being bent.

Check for scoring (Fig. 17). This is caused by insufficient lubrication.

Check for grooves caused by rod bolts or dirt scratching the journal during installation (Fig. 18).

Check the wear pattern (Fig. 18). It should be greater on the upper bearing.

Connecting rod bearings are available in one size only, 59.97 mm (2.36 in.)

Main Bearings

Check the main bearings for scoring, flaking, scratches and excessive or abnormal wear patterns. The lower bearing shell will have a larger wear pattern than the upper (grooved) shell. If the bearings are scored, scratched or grooved, check the main bearing journals of the crankshaft for nicks or scratches. Also check the oil

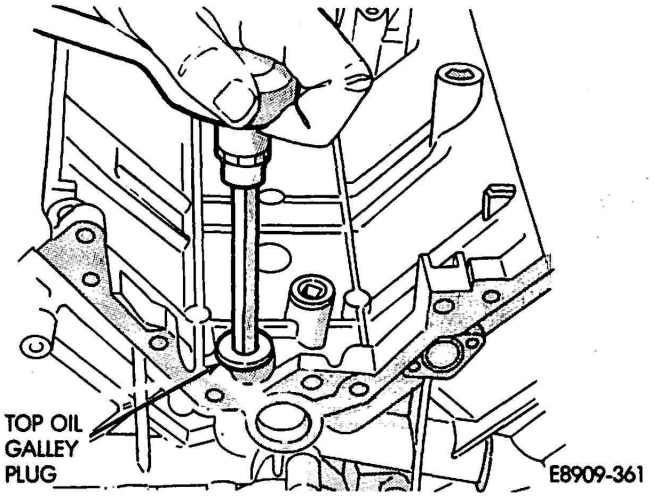


Fig. 14—Top Oil Galley Plug

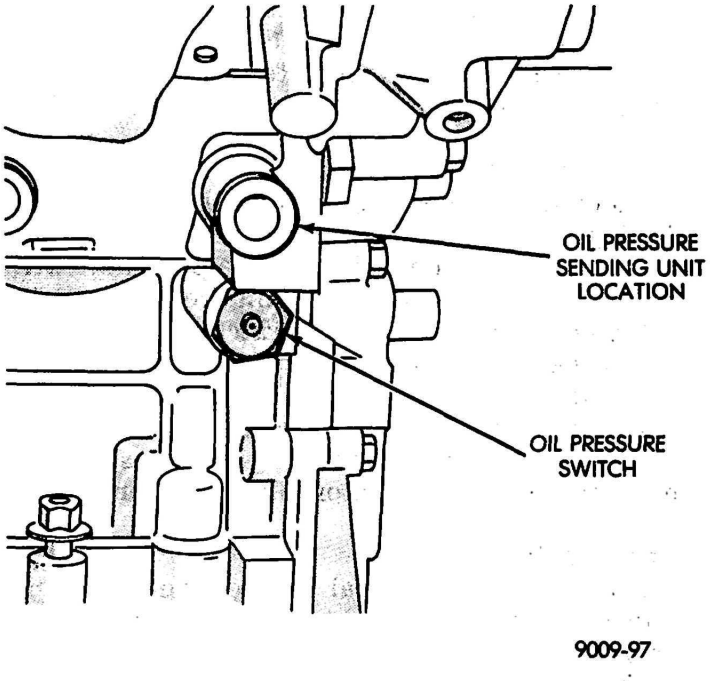


Fig. 15—Right Side Oil Galley Oil Pressure Sender Unit and Switch

passages in the cylinder block that feed the main bearings for blockage (Fig. 19).

Crankshaft

Check the oil passages from the main journals to the connecting rod journals for blockage. Check the journals for nicks and scratches. Polish any nick or scratches smooth.

Main bearings are available in one size only—70.06 mm (2.76 in).

Oil Pump Bores

Check the oil pump bores in the cylinder block for scoring. If the bores are scored, the cylinder block and pump must be replaced.

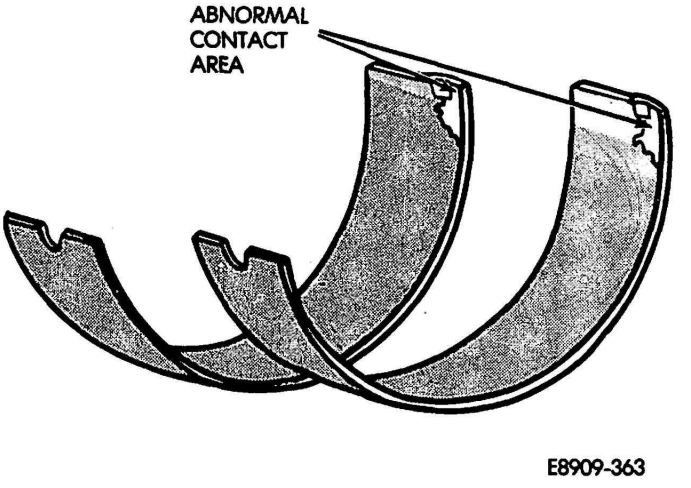


Fig. 16—Rod Bearing Abnormal Contact Area

Assembly

(1) Install the oil galley plugs with new gaskets.

(2) Check that the cylinder head bolts thread in and out of the bolt holes easily. It may be necessary to clean the threads.

(3) Upper main bearing shells have an oil groove down the middle (Fig. 20). Install them with the locating tabs on the back of the bearings positioned in the locating grooves of the cylinder block.

(4) The lower main bearing shells are not grooved. Install them into the main bearing caps.

(5) Thrust bearings are available as kits in four different sizes:

- 2.30-2.35 mm (.091-.093 in).
- 2.40-2.45 mm (.094-.096 in).
- 2.45-2.50 mm (.096-.098 in).
- 2.50-2.55 mm (.098-.100 in).

(6) Install new thrust bearing halves with the oil grooves facing out towards the thrust flanges of the crankshaft. The upper thrust bearing halves have a small tab on one side (Fig. 21). The tab rests in a notch in the cylinder block.

(7) Coat the back of the upper thrust bearing with Jeep/Eagle Super Oil Conditioner and install them to the grooves in the block. The oil groove in the bearings MUST face out.

(8) Apply a coating of clean engine oil to all of the upper main bearings (Fig. 21).

(9) Set crankshaft in place (Fig. 21).

(10) Lubricate the main bearing and connecting rod journals with clean engine oil.

(11) Install a set of lower thrust bearings to the rear No. 1 main bearing cap with the oil groves facing out (Fig. 21).

The main bearing caps are stamped one through four starting at the flywheel end of the engine. They must be installed in the correct order with tabs pointing forward (Fig. 22).

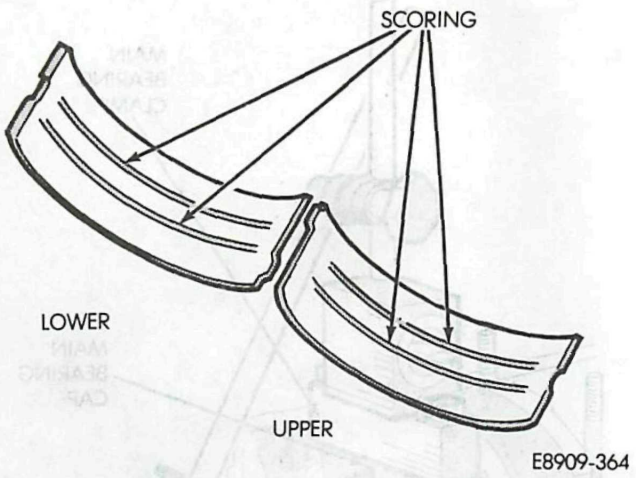


Fig. 17—Rod Bearing Scoring

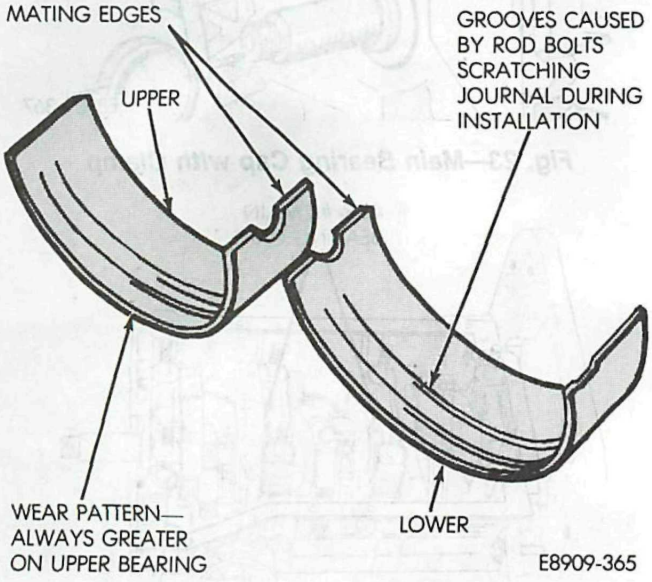


Fig. 18—Rod Bearing Grooves/Wear Pattern

(12) Install the front and rear main bearing caps with the tabs facing the crankshaft pulley end of the engine (Fig. 23).

(13) Install the main bearing clamps (Tool 6071) over the main bearing caps (Fig. 23). Use four of the lower casing mounting nuts to hold them in place. Tighten the nuts to 30 N·m (20 ft-lbs) torque.

(14) Place a magnetic base dial indicator onto the front main bearing cap clamp. Position the gauge against the front end of the crankshaft.

(15) With the crankshaft pushed towards the flywheel end, set the gauge to zero.

(16) Push the crankshaft towards the crankshaft pulley end of the engine until it stops.

(17) Check the amount of end play indicated on the *dial. It* should be between 0.07 mm and 0.27 mm (.003 in and .011 in).

(18) If the end play is not within this range use

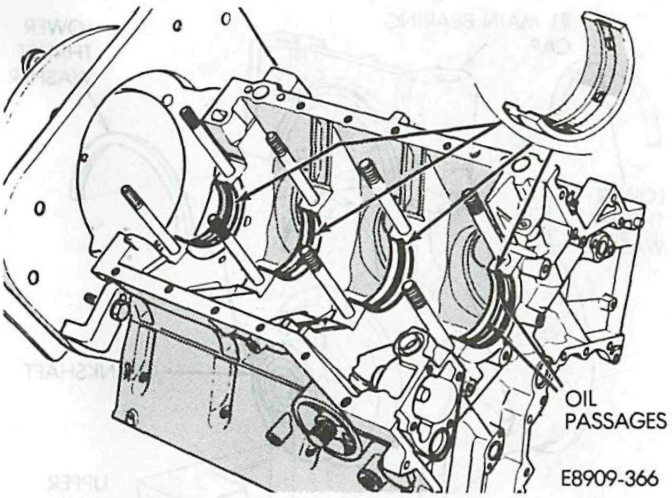


Fig. 19—Cylinder Block Oil Passages

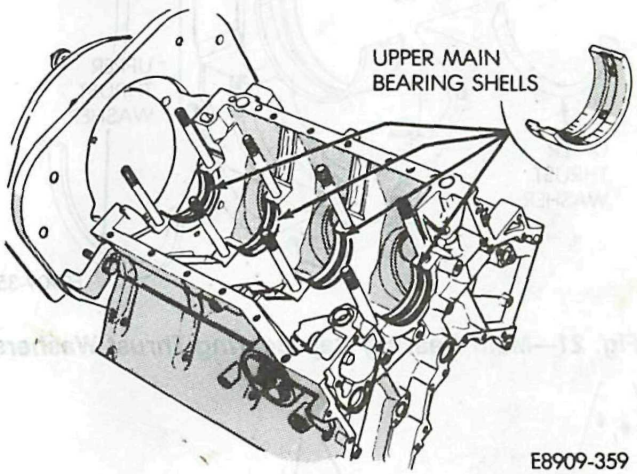


Fig. 20—Upper Main Bearing Shells

thrust bearings of a different thickness until the correct end play is obtained.

(19) Install crankshaft turning tool (Tool 6072).

(20) Remove the main bearing cap clamps.

(21) Install No. 2 and No. 3 main bearing caps with the tabs pointing forward (Fig. 24).

(22) Install a new O-ring seal on the oil pump entry tube (Fig. 24). When assembling the cylinder block, the O-ring seals for the lower casing and oil pump inlet tube MUST be replaced. Also replace the oil galley plug gaskets (washers).

(23) Install the crankshaft rear seal housing with a new gasket. Install, finger tight, two mounting bolts at positions (1) and (4).

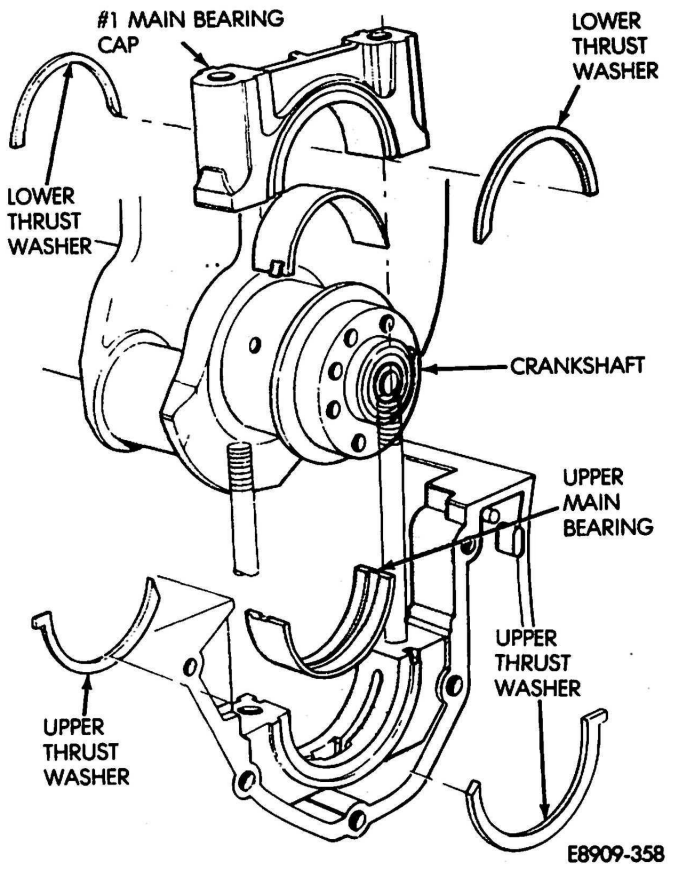


Fig. 21—Main Bearing Cap/Bearing/Thrust Washers

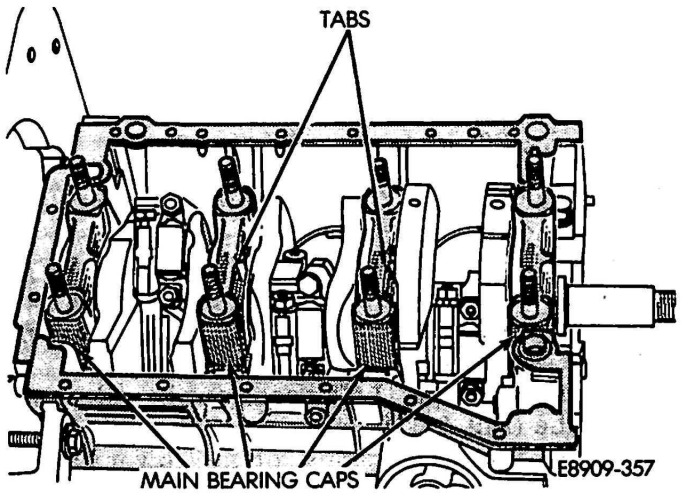


Fig. 22—Position of Main Bearing Caps

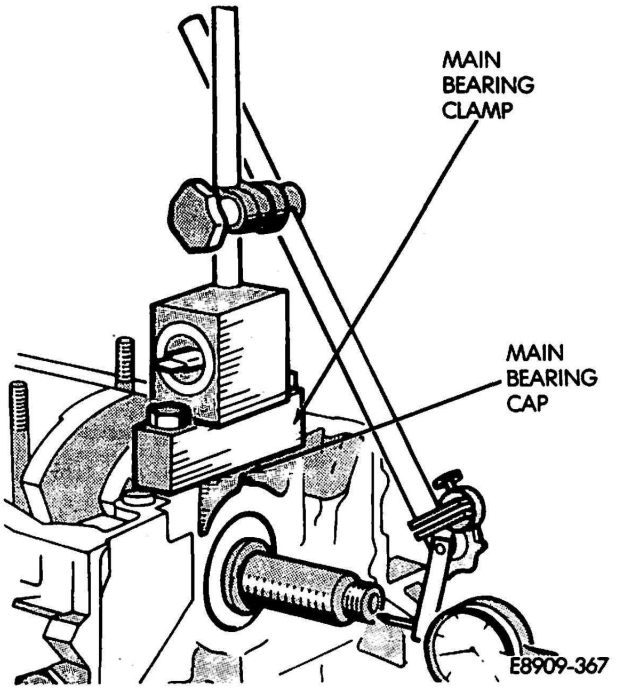


Fig. 23—Main Bearing Cap with Clamp

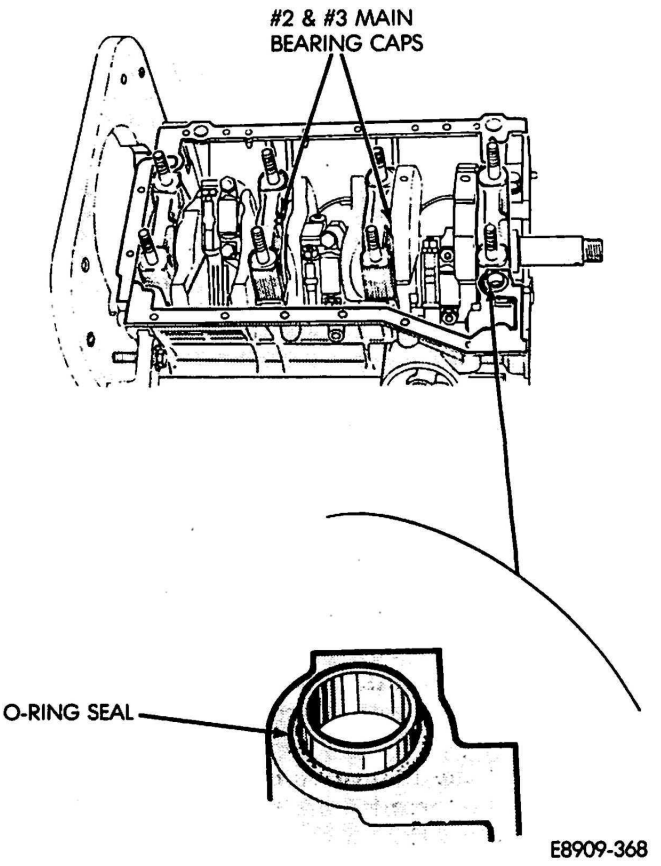


Fig. 24—Main Bearing Caps and O-Ring Seal

CAUTION: When installing the lower casing, alignment plate (Tool 6140) must be used. Use of this alignment plate will ensure correct positioning of the lower casing and will avoid distortion to the convertor housing of the transmission.

(24) Apply a bead of Jeep/Eagle Gasket-in-a-Tube to the mating surface of the cylinder block.

(25) Place the lower casing over the cylinder block and install the flat washers. Start the nuts onto the studs, but do not tighten them.

(26) Insert casing bolts into the bolt holes but, do not tighten them.

(27) Insert the casing to the rear seal housing bolts into the bolt holes but, do not tighten them (Fig. 25).

(28) Push the lower casing forward and using the bolts supplied, attach lower casing alignment plate (Tool 6140) with the machined bosses on the plate facing the rear of the engine. The bolts thread into the rear crankshaft seal housing mounting bolt holes. Slightly tighten the bolts.

(29) Pull the lower casing back against the alignment plate then proceed with tightening the casing nuts.

(30) Pretighten the nuts in the sequence shown to 30 N·m (20 ft-lbs) torque (Fig. 26).

(31) Starting at position #1 and proceeding in sequence.

- Attach an angular wrench (Tool 7321) between a socket and ratchet (Fig. 27).
- Turn the angular wrench until the locking arm rests against a solid object.
- Attach the magnetic base of the pointer to another nut or bolt (Fig. 27).

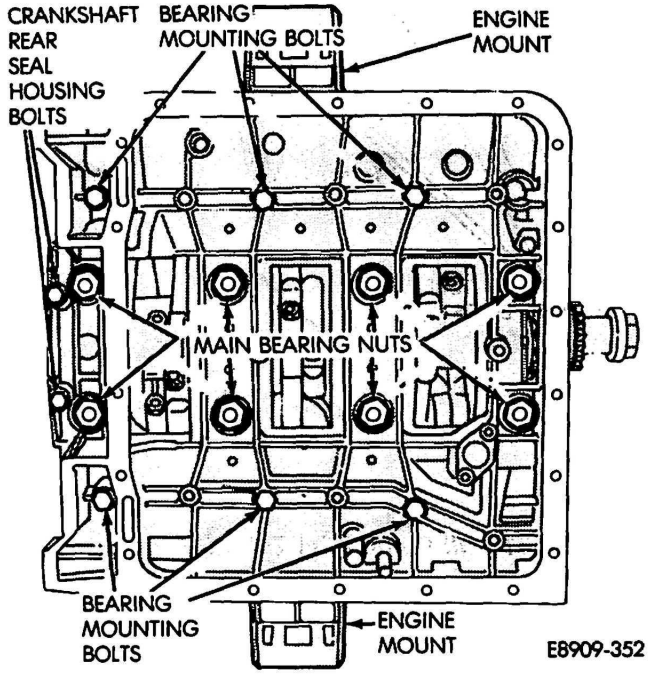


Fig. 25—Lower Casing

- Position the end of the pointer so that it is aligned with the 75° mark on angular wrench.
- Tighten the nuts until the zero on the dial align with the end of the pointer.

(32) Repeat the angular tightening, in sequence, for the remaining nuts.

(33) Remove the alignment plate.

(34) Tighten the lower casing to rear crankshaft seal housing bolts to 12 N·m (9 ft-lbs)—(Fig. 28).

(35) Install the remaining seal housing bolts and tighten them to 15 N·m (11 ft-lbs) torque.

(36) Tighten the casing bolts to 17 N·m (13 ft-lbs).

(37) Install a new rear crankshaft oil seal using Tool 6482 (Fig. 29). Lubricate the seal prior to installing it.

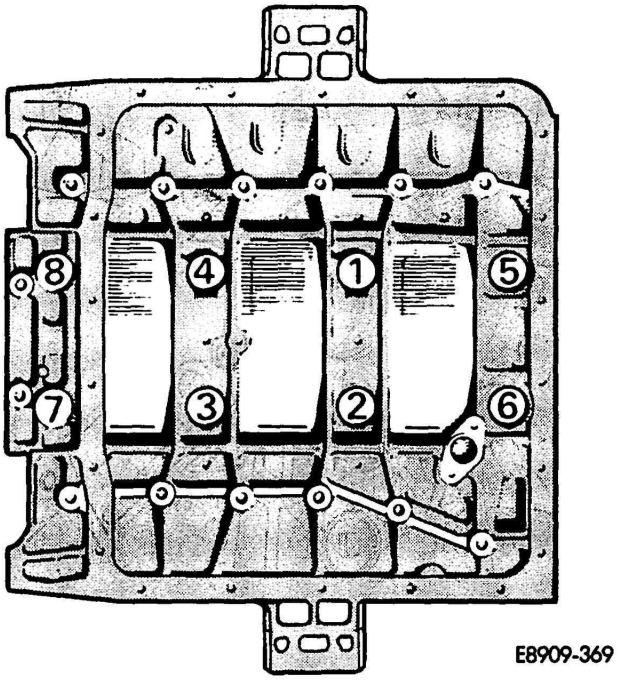


Fig. 26—Lower Casing Nut Tightening Sequence

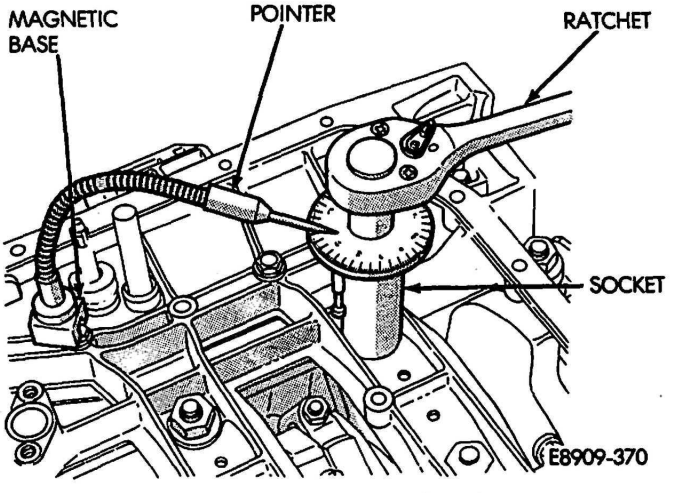


Fig. 27—Lower Casing Angular Tightening

(38) Gently tap the seal into place until the installer stops.

(39) Remove the installer by turning and pulling it at the same time.

(40) Install the oil baffle (Fig. 30). Tighten the oil baffle mounting bolts to 12 N·m (9 ft-lbs) torque. Tighten bearing mounting bolts to 17 N·m (13 ft-lbs) torque.

(41) Install a new O-ring seal on the bottom of the oil pump inlet tube (Fig. 31).

(42) Install the oil pump inlet tube (Fig. 31). Tighten the mounting bolts to 12 N·m (9 ft-lbs) torque.

(43) Install dry, a new oil pan gasket to the lower casing.

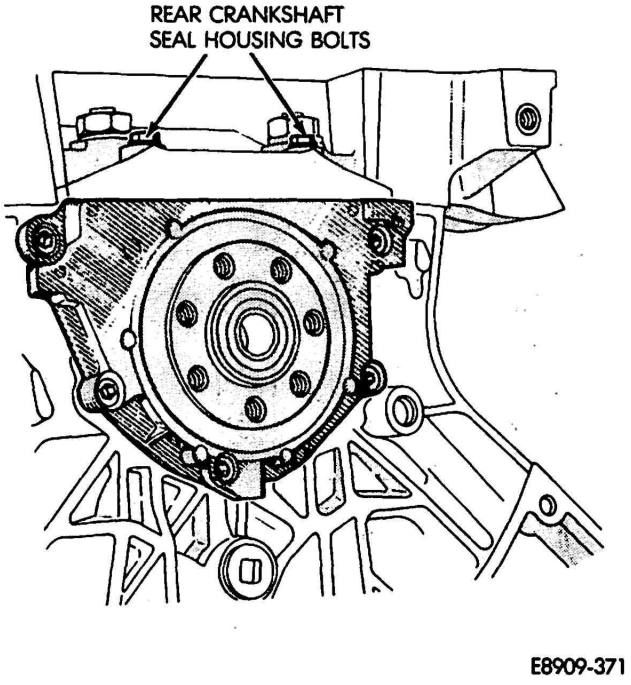


Fig. 28—Crankshaft Seal Housing

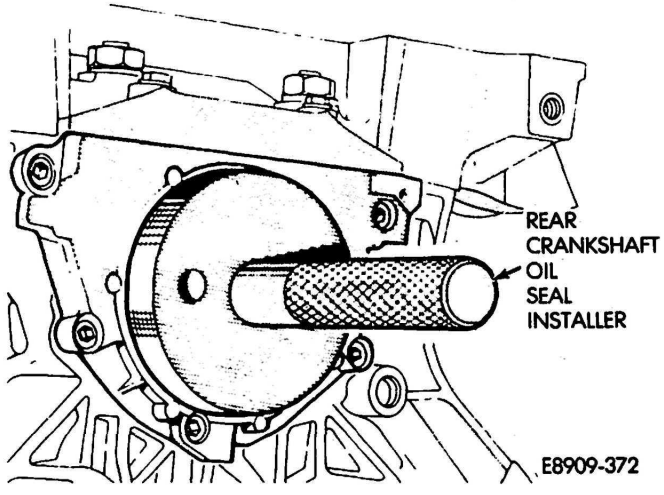


Fig. 29—Install Rear Crankshaft Oil Seal

(44) Install the oil pan. Tighten the mounting bolts to 12 N·m (9 ft-lbs) torque.

(45) Install the oil pan drain plug using a new gasket (washer). Tighten the plug to 30 N·m (22 ft-lbs) torque.

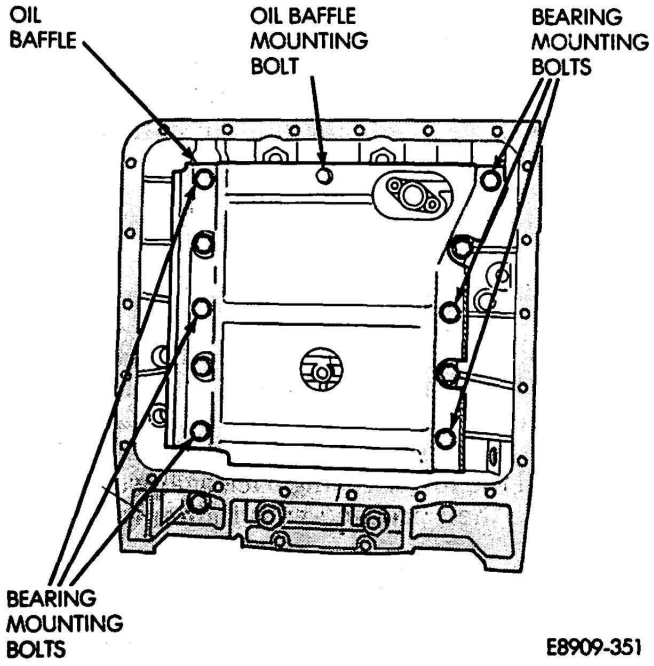


Fig. 30—Oil Baffle

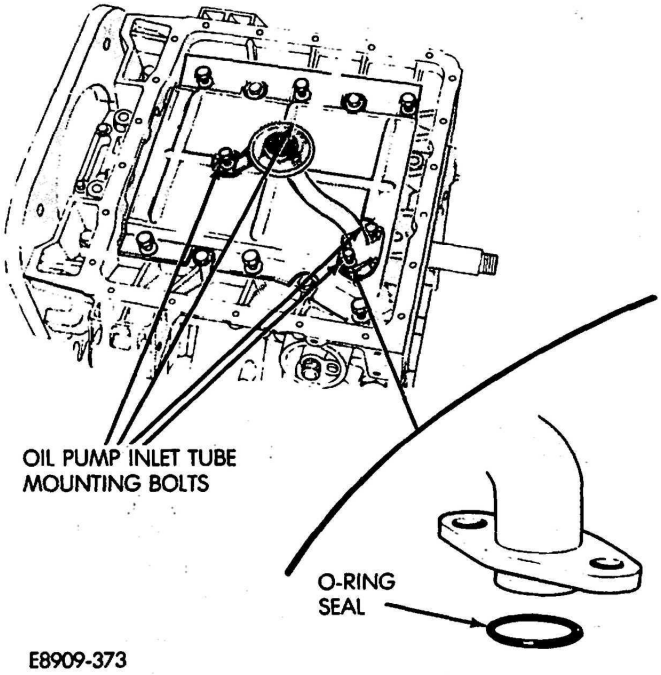


Fig. 31—Oil Pump Inlet Tube/O-Ring Seal

CYLINDER LINER

Cylinder Liner Kits

Kits containing cylinder liners, pistons, piston pins and piston rings are available (Fig. 1). The components of the kits are pre-measured and matched to each other ensuring correct clearances. Each kit contains one of each component. **CAUTION: All parts of the kits are coated with a preservative that can be removed with Acetone. Do not scrape the coating off of any component in the kit.**

Connecting rods are not part of the kits and are available separately.

Mark the components of each kit with the same letter so that they are not mixed with another kit. For example, if six kits are used mark all components of the first kit with an A, the second kit with a B, etc.

If the old connecting rod(s) are to be reused, press the piston pins out (refer to the Piston-Connecting Rod Section—Disassembly).

Liner Protrusion

When the cylinder liner and liner seal are installed into the cylinder block, the top of liner protrudes above the cylinder block deck. The protrusion specification is 0.05 mm to 0.12 mm (.002 in to .005 in).

The amount of protrusion is adjustable by using different thickness cylinder liner seals.

A steel cylinder liner seal is used to seal between the liner and the cylinder block.

Liner seals are available in 3 thicknesses, identified by the color of the seal (Fig. 2). The liner seals are made with an anti-corrosion coating that changes the actual seal thickness.

If the original cylinder liner-piston-connecting rod are being reused, position the liners in the same bore from which they were removed. Use a new liner seal of the same thickness (colore) as the discarded seal. Align the marks that were made on the cylinder block and liner when the engine was disassembled.

If new cylinder liner-piston assemblies are being used, place the new liners with a new seal into the cylinder block. Check the liner protrusion. Since the liners are new, it is not necessary to place the liners in any particular order or to turn the liner to any specific position when installing.

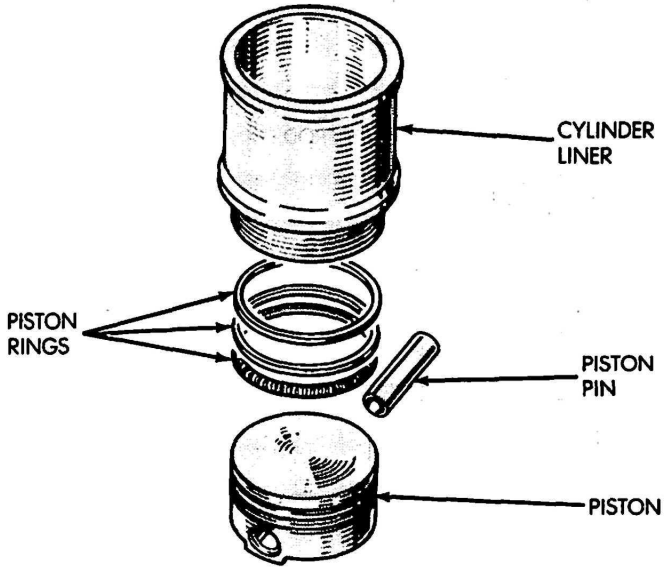
Check the liner protrusion using a dial gauge at positions (L) and (M)—(Fig. 3). The liner protrusion specification is between 0.05 mm and 0.12 mm (.002 in and .005 in).

SEAL COLOR	THICKNESS
RED	0.10 mm (0.004 in)
SILVER	0.12 mm (0.005 in)
BLUE	0.15 mm (0.006 in)

SEAL COLOR	THICKNESS & COATING
RED	0.116 ±0.018 mm (0.0045 ±0.0007 in)
SILVER	0.136 ±0.018 mm (0.0055 ±0.0007 in)
BLUE	0.166 ±0.028 mm (0.0065 ±0.0011 in)

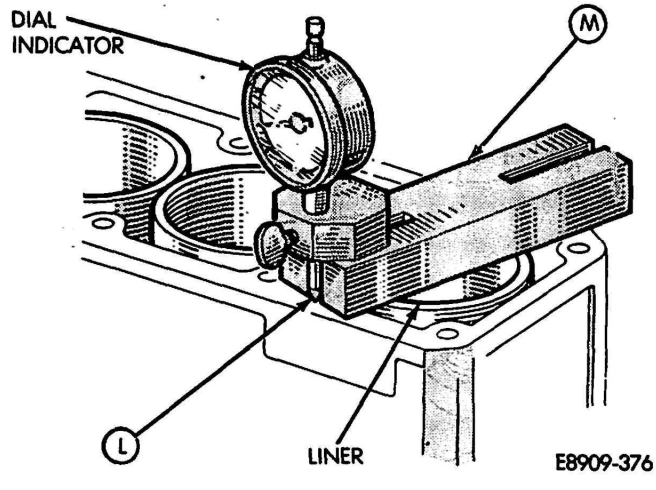
E8909-375

Fig. 2—Liner Seal Identification



E8909-374

Fig. 1—Cylinder Kit



E8909-376

Fig. 3—Measuring Liner Protrusion

The difference in protrusion between any two adjacent cylinder liners is not to exceed 0.04 mm (.0016 in) within the range of 0.05 mm and 0.12 mm (.002 in and .005 in).

Adjust liner protrusion so that the amount of protrusion is greatest at the No. 1 position on the left bank and the No. 4 position on the right bank, and steps down in amounts to No. 3 (left bank) or No. 6 (right bank)—(Fig. 4) Use different thickness liner seals as necessary.

Once the correct protrusions have been obtained, group the assemblies (kits), A, B, C, D, E and F together and then number the cylinder liners, pistons and piston pins from 1 to 6 so that they match the corresponding connecting rod. If the original cylinder liner-piston-connecting rod assemblies are being reused, place the cylinder liner with the corresponding piston assembly.

PISTON-CONNECTING ROD

Disassembly

(1) Remove the piston connecting rod assembly from the cylinder liner by pulling it out the bottom of the liner.

(2) Use the piston support block, the anvil and the extractor rod of the piston pin removal/installation kit (Tool 7305) to press the piston pin from the piston and connecting rod (Fig. 5).

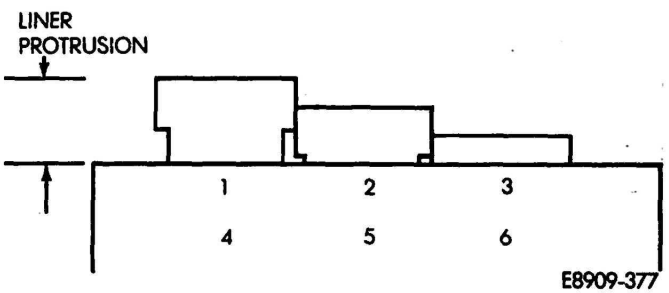


Fig. 4—Liner Protrusion Between Cylinders

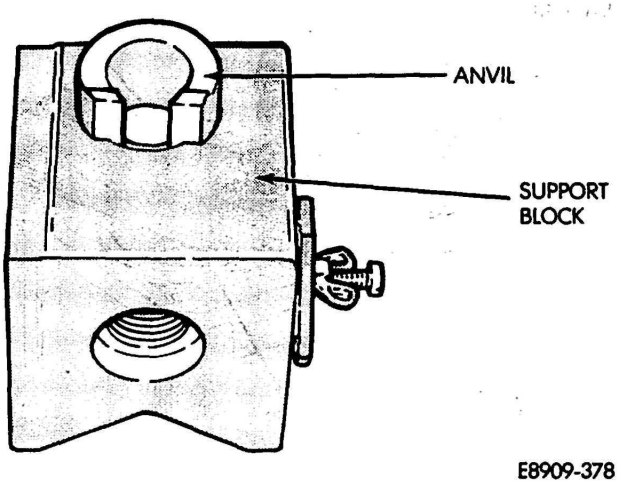


Fig. 5—Piston Pin Removal/Installation

(3) Turn the piston support block so that it rests on the "V" section. Place the anvil into the top of the support.

(4) Position the piston over anvil and pilot the bottom edge of the pin into the anvil to center the piston (Fig. 6). Install extracting rod into the top of the piston. Press the piston pin out of the connecting rod.

Assembly

(1) Check the connecting rods for twist or bend:

- Max. Twist—0.051 mm (.002 in).
- Max. Bend—0.076 mm (.003 in).

(2) Check the condition of the large end. Use Arkansas smooth stone to remove any nicks and burrs that are found.

(3) Check the condition of the pin bore in the small end of the connecting rod. Use an oil stone to remove all nicks and burrs.

(4) Check the diameter of the pin bore. It must be between 24.959 mm and 24.971 mm (.9826 in and .9831 in) to ensure the correct interference fit between the pin bore and the piston pin.

Pistons 1, 2 and 3—Left Bank

The piston, piston pin and connecting rod are assembled by heating the small end of the connecting rod until the piston pin bore expands. Slide the pin through the piston and the connecting rod. As the small end cools the pin bore contracts, forming an interference fit with the piston pin.

Use a 1500 watt hot plate to heat the small end of the connecting rod (Fig. 7).

Place the small end of the connecting rods 1, 2 and 3 squarely on the hot plate with the shoulder of the large end towards the bottom (Fig. 7).

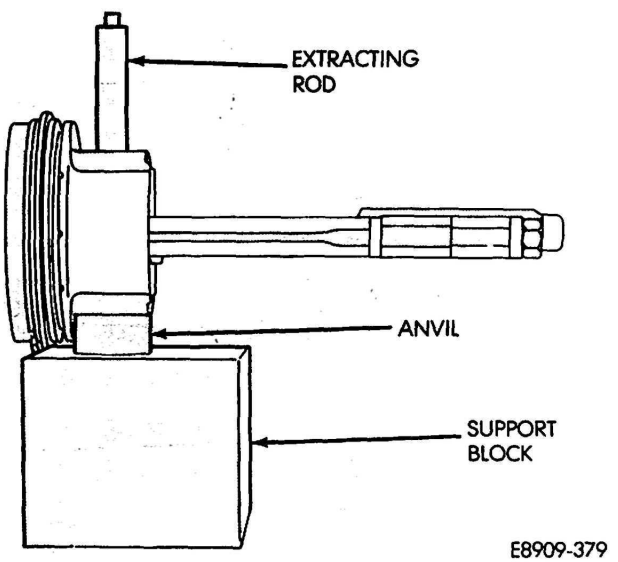


Fig. 6—Support Block/Anvil

Use a small piece of solder with a melting point of 250° C (480°F) as a temperature guide. Place the solder on each small end (Fig. 7).

Heat up the connecting rod small ends until the solder liquefies.

Insert the piston pin into the pin bore of the piston. It should rotate freely.

Use Mandrel A-8 and Guide C-9 from Piston Pin Removal and Installation Kit (Tool 7305) to install the piston pin (Fig. 8).

Position the piston pin in between the mandrel and the guide. Do not tighten the mandrel, back it off one turn from the piston pin so that the pin floats freely between the mandrel and the guide.

Lubricate the guide and piston pin with clean engine oil.

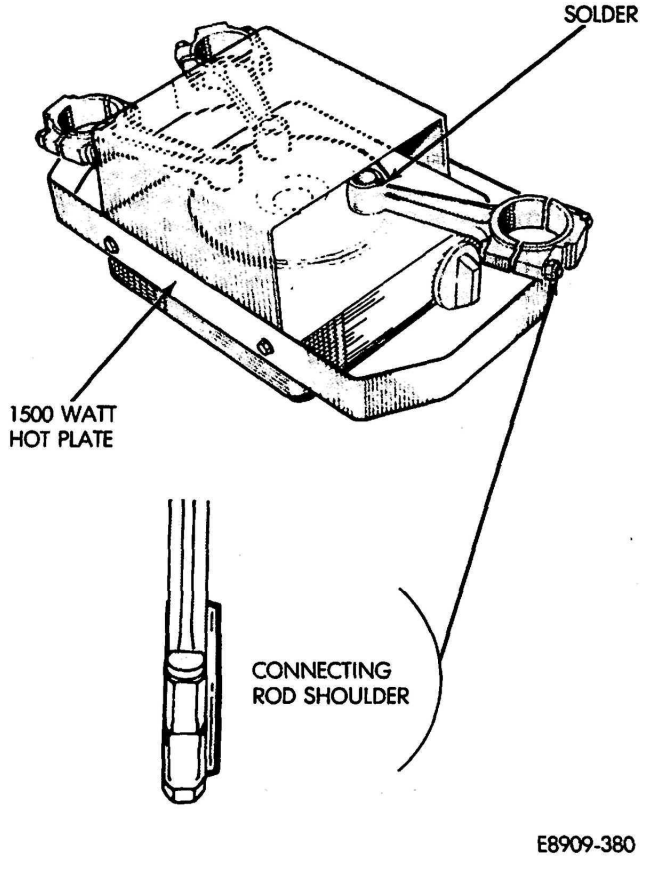


Fig. 7—1500 Watt Hot Plate

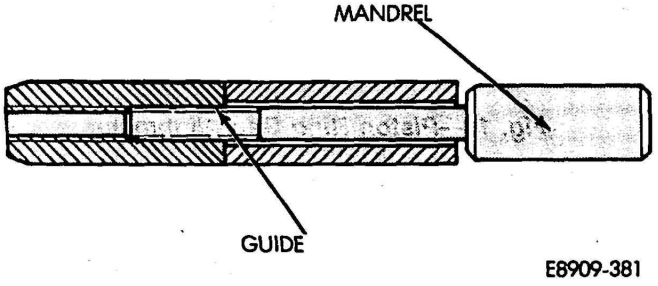


Fig. 8—Install Piston Pin

When assembling the left bank pistons (Nos. 1, 2 and 3) the shoulder on the connecting rod large end must be opposite the arrow on the piston crown (Fig. 9).

From piston pin removal/installation kit (Tool 7305), place the anvil on top of the support block with the flat side opposite the retaining clip clamp (Fig. 10).

Clamp the piston, with the arrow pointing up, to the support. To center the piston to the anvil, slide the mandrel-piston pin-guide through the piston and the anvil. This will align the pin bore and anvil. Lightly tighten the clip. Pull the mandrel-piston pin-guide assembly up and out of the piston.

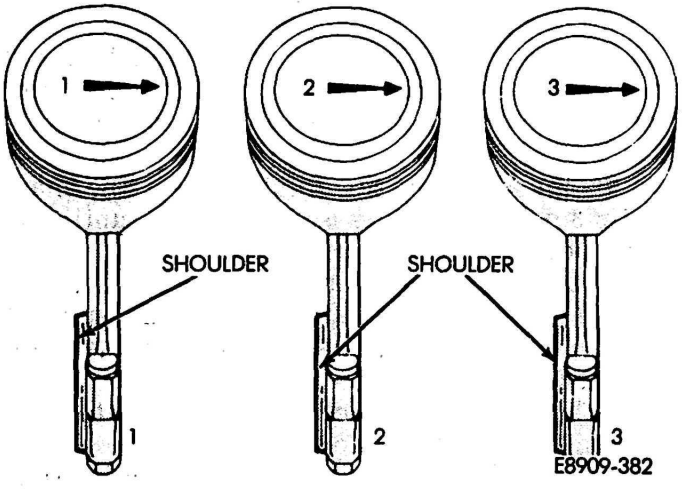


Fig. 9—Position of Shoulder on Conn. Rod

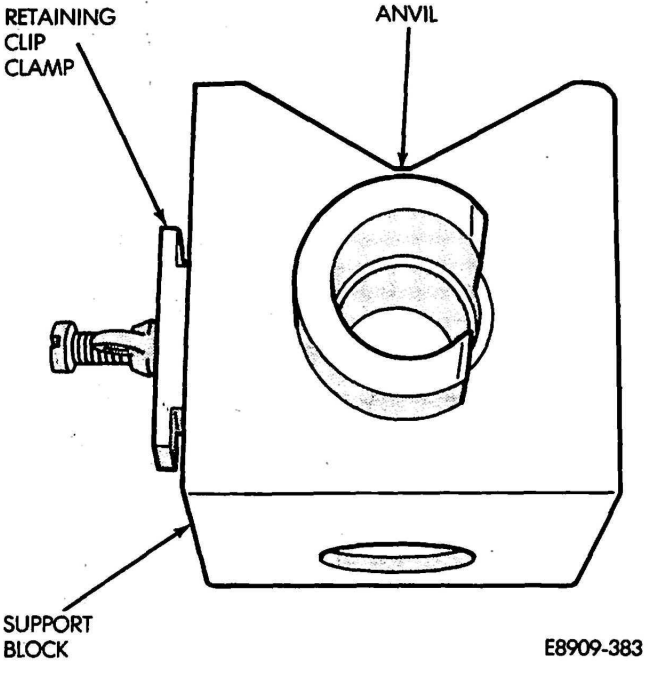


Fig. 10—Position of Anvil on Support Block

The following procedure must be performed as quickly as possible to prevent the connecting rod small end from cooling and contracting before the piston pin is completely installed.

Ensure that the solder is liquefied on the small end of the connecting rod.

When assembling the connecting rods for cylinders 1, 2 and 3, the piston must be clamped in place on support block with the arrow up and the connecting rod installed with the shoulder pointing down (opposite the arrow on the piston).

Wipe the solder from the small end of the connecting rod.

Insert the guide end of the mandrel-piston pin-guide assembly (A-8) into the top of the piston pin bore (but not down into the center of the piston)—(Fig. 11).

Using one hand, remove the connecting rod from the hot plate and, with the shoulder pointing down, insert the connecting rod into the support block (Fig. 11).

With the other hand, quickly press the mandrel-piston pin-guide assembly down until the guide bottoms out in the support bracket.

Wait ten (10) seconds and then remove the connecting rod-piston assembly from the support block. Unscrew the guide and remove the mandrel (A-8).

Check that the connecting rod and piston pin are centered to the piston.

Assemble the other two piston-connecting rods in the same manner.

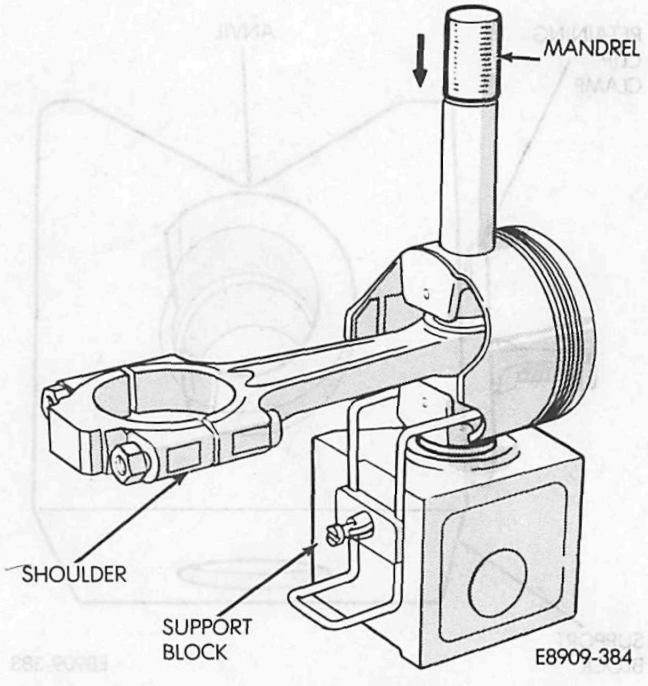


Fig. 11—Piston Pin Installation

Pistons 4, 5 and 6—Right Bank

Place the small ends of the connecting rods 4, 5 and 6 squarely onto the hot plate with the shoulder on the large end pointing up.

Place the piston on the support block with the arrow pointing up.

When installing the right bank pistons (4, 5 and 6), the shoulder on the connecting rod large end must be on the same side as the arrow on the piston crown.

Assemble the piston-connecting rods as described for the left bank except, insert the connecting rods into the piston with the shoulder pointing up (Fig. 12).

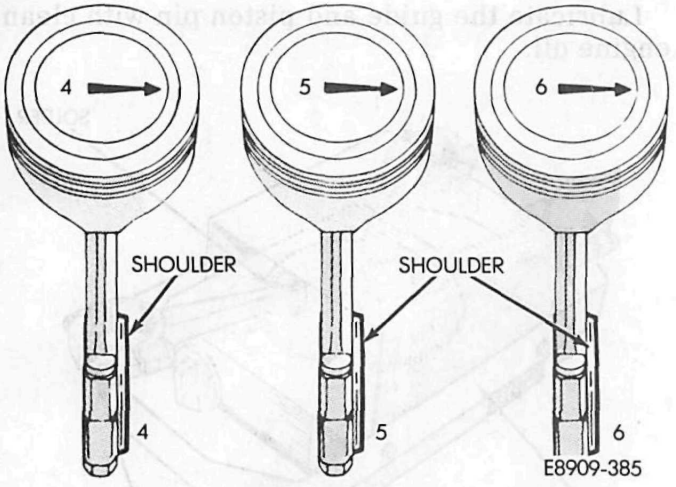


Fig. 12—Position of Conn. Rod Shoulder

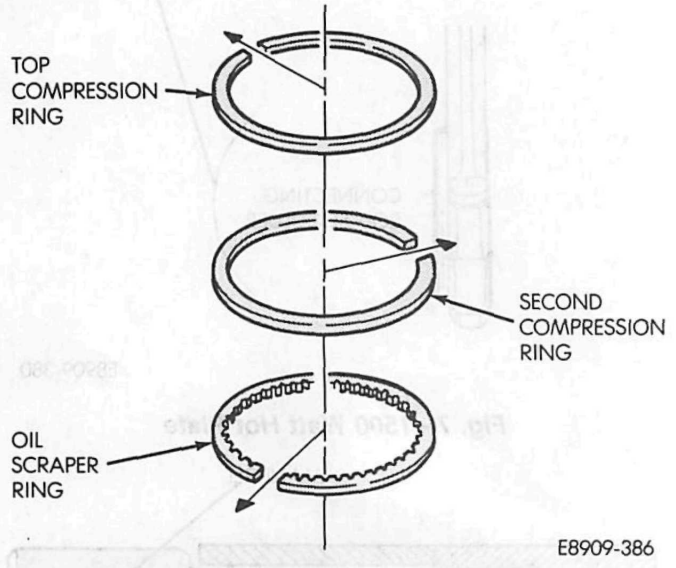


Fig. 13—Piston Ring Gap Alignment

PISTON RING REPLACEMENT

The scraping edge of the top compression ring is not tapered and can be installed with either side up (Fig. 13).

The scraping edge of the second compression ring is tapered and must be installed with the side marked "top" facing up (Fig. 13).

The oil scraper ring is a Goetze design ring and can be installed with either side up (Fig. 13).

Install the rings with each end gap 120° from each other.

The piston ring end gap has been pre-set to the cylinder liner. There is no need to trim the ring ends.

CAUTION: The top of the cylinder liner is not chamfered. Do not install the piston from the top of the liner because damage to the piston rings and ring lands can occur. The piston MUST be installed from the bottom of the liner.

Lubricate the piston, piston pin and cylinder liner with clean engine oil.

Use a piston ring compressor to install the piston into the cylinder liner from the bottom (Fig. 14).

Install the connecting rod bearings.

CAUTION: When installing the piston liner assembly into the cylinder block, slide insulators made from rubber hose over the ends of the connecting rod bolts to prevent nicking the crankshaft journals.

Turn the crankshaft so that the connecting rod journal of the cylinder to be installed is at the bottom of its stroke and centered to the liner bore of the cylinder block.

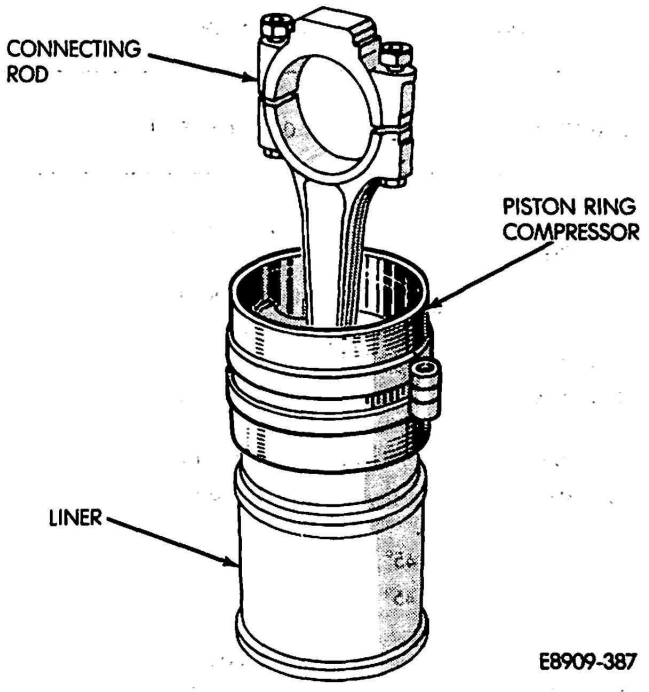


Fig. 14—Piston Ring Compressor

If original cylinder liner and pistons are being reused, be sure to align the marks that were made on both during disassembly.

Install cylinder liner-piston assemblies 1, 2 and 3 on the left bank of the engine with the arrow on the crown of the piston pointing toward crankshaft pulley end and shoulder of the connecting rod pointing to flywheel end of the engine (Fig. 15).

Install the connecting rod cap and finger tighten the connecting rod nuts. Do not tighten the connecting rod nuts until all cylinder liner-piston assemblies are installed.

Use liner clamps (Tool 7315) to hold the liners in place before installing the next assembly.

Install cylinder liner-piston assemblies 4, 5 and 6 on the right bank of the engine with both the arrows on the crown of the piston and shoulder of the connecting facing the crankshaft pulley end of the engine.

Tighten all of the connecting rod nuts to 42 N·m (31 ft-lbs) torque.

Using feeler gauges or a magnetic base dial indicator check the connecting rod side clearance at each journal. The side clearance must be between 0.20 mm and 0.38 mm (.008 in and .015 in).

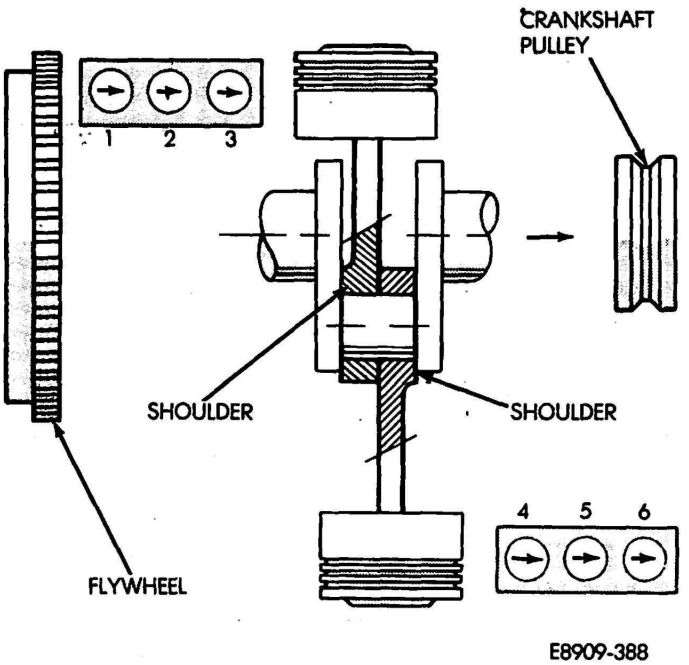


Fig. 15—Positioning of Piston/Conn. Rod

CAMSHAFT

END PLAY	0.07-0.14 MM	.003-.0055 IN.
INTAKE VALVE		
OPEN	14° BTDC (BEFORE TOP DEAD CENTER)	
CLOSES	58° ABDC (AFTER BOTTOM DEAD CENTER)	
EXHAUST VALVE		
OPEN	56° BBDC (BEFORE BOTTOM DEAD CENTER)	
CLOSES	12° ATDC (AFTER TOP DEAD CENTER)	
VALVE OVERLAP	26°	
INTAKE DURATION	252°	
EXHAUST DURATION	248°	

CONNECTING RODS

LENGTH (SMALL END TO LARGE END CENTERLINE)	146.15 MM	5.75 IN.
PISTON PIN BORE DIAMETER	24.959-24.971 MM	0.9826-0.9831 IN.
CONNECTING ROD BEARING BORE (WITHOUT BEARINGS)	63.704 MM	2.508 IN.
SIDE CLEARANCE	0.20-0.38 MM	0.008-0.015 IN.
MAXIMUM TWIST	0.075 MM	0.002 IN.
MAXIMUM PARALLEL (BEND)	0.080 MM	0.003 IN.
WEIGHT	752.5-757.5 G.	26.545-26.721 OZ.

CRANKSHAFT

END PLAY	0.07-0.27 MM	.003-.010 IN.
MAIN BEARING JOURNAL DIAMETER	70.043-70.062 MM	2.7576-2.7583 IN.
MAIN BEARING CLEARANCE	0.038-0.089 MM	0.0015-0.0035 IN.
CONNECTING ROD JOURNAL DIAMETER	59.971-59.990 MM	2.3611-2.3618 IN.
MAIN BEARING BORE IN BLOCK	74.000-74.019 MM	2.9134-2.9141 IN.

CYLINDER BLOCK

LINER PROTRUSION	0.05-0.12 MM	0.002-0.005 IN.

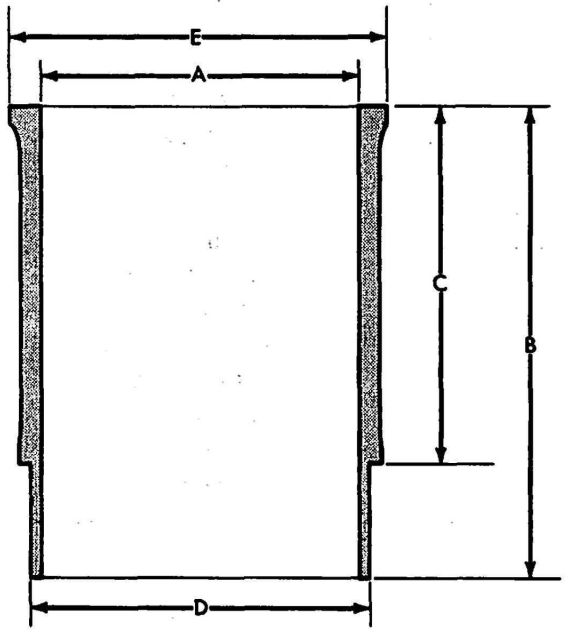
CYLINDER HEAD

COMBUSTION CHAMBER VOLUME	50.6 CC	3.09 CU. IN.
VALVE GUIDE I.D. (INSIDE DIAMETER)	8.0 MM	0.315 IN.
VALVE GUIDE O.D. (OUTSIDE DIAMETER)	13.0 MM	0.512 IN.
REPAIR VALVE GUIDE O.D.	13.35 MM	0.526 IN.
VALVE GUIDE LENGTH		
INTAKE	45.0 MM	1.772 IN.
EXHAUST	49.0 MM	1.929 IN.
VALVE SEAT ANGLE		
INTAKE	45°	
EXHAUST	45°	
FLATNESS (MAX. WARPAGE) (NOT RESURFACEABLE)	0.051 MM	0.002 IN.
HEAD GASKET THICKNESS	1.45 MM	0.057 IN.
CYLINDER HEAD HEIGHT	110.83 MM	4.363 IN.

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CYLINDER LINER

LINER INSIDE DIAMETER (A)		
3 CLASSES OF LINER IDENTIFIED BY NOTCHES ON LINER TOP		
1 NOTCH	93.00-93.01 MM	3.6614-3.6618 IN.
2 NOTCHES	93.01-93.02 MM	3.6618-3.6622 IN.
3 NOTCHES	93.02-93.03 MM	3.6622-3.6626 IN.
LINER TOTAL LENGTH (B)	131.10 MM	5.16 IN.
LINER LENGTH (C) TOP TO BLOCK SEAT	89.975 MM	3.54 IN.
LINER OUTSIDE DIAMETER (D)	97.68 MM	3.85 IN.
LINER OUTSIDE DIAMETER (E)	107.2 MM	4.22 IN.



CYLINDER LINER SEAL

LINER SEAL THICKNESS IDENTIFIED BY TABS ON THE SEAL		
RED	0.10 MM	0.004 IN.
SILVER	0.12 MM	0.005 IN.
BLUE	0.15 MM	0.006 IN.

OIL PRESSURE

AT IDLE SPEED (790 RPM)	101 KPA (14.7 PSI)
AT 4000 RPM	414 KPA (60 PSI)

NOTE: CHECK OIL PRESSURE ONLY WHEN THE THERMOSTAT IS OPEN AND THE ENGINE COOLANT TEMPERATURE IS AT 89°C (192°F).

ROCKER ARM

ROCKER ARM DIAMETER	19.959-19.976 MM	0.786-0.787 IN.

PISTONS

COMPRESSION HEIGHT (PIN BORE CENTERLINE TO PISTON TOP)	38.7 MM	1.524 IN.
PISTON RING END GAP (CLEARANCE)		
#1 COMPRESSION RING	0.40-0.55 MM	0.016-0.022 IN.
#2 COMPRESSION RING	0.40-0.55 MM	0.016-0.022 IN.
OIL CONTROL RING	N/A — SEGMENTED RING	
PISTON RING SIDE CLEARANCE		
#1 COMPRESSION RING	0.03-0.05 MM	0.001-0.002 IN.
#2 COMPRESSION RING	0.03-0.05 MM	0.001-0.002 IN.
OIL CONTROL RING	0.04-0.09 MM	0.0015-0.0035 IN.
PISTON RING THICKNESS		
#1 COMPRESSION RING	1.75 MM	0.069 IN.
#2 COMPRESSION RING	1.75 MM	0.069 IN.
OIL CONTROL RING	3.44-3.47 MM	0.135-0.137 IN.
PISTON RING GROOVE HEIGHT		
#1 COMPRESSION RING	1.78-1.80 MM	0.070-0.071 IN.
#2 COMPRESSION RING	1.78-1.80 MM	0.070-0.071 IN.
OIL CONTROL RING	3.51-3.53 MM	0.138-0.139 IN.
PISTON RING GROOVE DIAMETER (INSIDE)		
#1 COMP. RING GROOVE	84.30-84.50 MM	3.319-3.327 IN.
#2 COMP. RING GROOVE	83.70-83.90 MM	3.295-3.303 IN.
OIL CONTROL RING GROOVE	82.80-83.00 MM	3.260-3.268 IN.
PISTON RING BORE DIAMETER	25.004-25.013 MM	0.9844-0.9848 IN.
PISTON PIN DIAMETER	24.991-25.000 MM	0.9839-0.9843 IN.
PISTON PIN TO BORE CLEARANCE	0.004-0.022 MM	0.0015-0.0085 IN.
PISTON PIN I.D.	15.0 MM	0.591 IN.
PISTON PIN LENGTH	66.0 MM	2.598 IN.

VALVES

VALVE LENGTH		
INTAKE VALVE	112.45 MM	4.427 IN.
EXHAUST VALVE	111.45 MM	4.388 IN.
VALVE STEM DIAMETER	8.0 MM	0.315 IN.
VALVE HEAD DIAMETER		
INTAKE VALVE	45.3 MM	1.783 IN.
EXHAUST VALVE	38.5 MM	1.516 IN.
VALVE FACE ANGLE	45°	
VALVE FACE WIDTH		
INTAKE VALVE	1.45-2.21 MM	0.057-0.087 IN.
EXHAUST VALVE	1.6-2.64 MM	0.063-0.104 IN.
VALVE MARGIN		
INTAKE VALVE	1.50 MM	0.059 IN.
EXHAUST VALVE	1.70 MM	0.067 IN.

VALVE SPRINGS

FREE LENGTH	48.5 MM	1.909 IN.
SPRING TENSION		
VALVE CLOSED	337 N @ 40 MM	76 LB. @ 1.575 IN.
VALVE OPEN	691 N @ 31 MM	155 LB. @ 1.220 IN.

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COMPONENT	TORQUE	
AIR CLEANER HOSE CLAMP	3.4 N•M	30 IN-LBS
A/C COMPRESSOR MOUNTING BOLT	27 N•M	20 FT-LBS
ALTERNATOR LOCKING BOLT	27 N•M	20 FT-LBS
ALTERNATOR PIVOT BOLT	50 N•M	37 FT-LBS
BATTERY CABLE TO STARTER NUT	9 N•M	80 IN-LBS
CAMSHAFT SPROCKET BOLT	80 N•M	59 FT-LBS
CAMSHAFT THRUST PLATE MOUNTING BOLT	12 N•M	9 FT-LBS
CONNECTING ROD NUT	47.5 N•M	35 FT-LBS
CRANKSHAFT PULLEY NUT	180 N•M	133 FT-LBS
CRANKSHAFT REAR SEAL HOUSING BOLT	12 N•M	9 FT-LBS
CROSSMEMBER TO CRADLE NUT	60 N•M	44 FT-LBS
CYLINDER HEAD BOLT (TORQUE VERIFICATION)	70 N•M	52 FT-LBS
CYLINDER HEAD COVER BOLT	12 N•M	9 FT-LBS
CYLINDER HEAD REAR COVER BOLT	6 N•M	53 IN-LBS
DIFFERENTIAL COVER BOLT	27 N•M	20 FT-LBS
DISTRIBUTOR CAP MOUNTING BOLT	9 N•M	80 IN-LBS
DISTRIBUTOR ROTOR MOUNTING BOLT	3 N•M	26 IN-LBS
ENGINE CRADLE MOUNTING BOLT	125 N•M	92 FT-LBS
ENGINE DAMPER BOTTOM LOCKNUT	27 N•M	20 FT-LBS
ENGINE DAMPER TOP NUT	43 N•M	32 FT-LBS
ENGINE MOUNT NUT	65 N•M	48 FT-LBS
ENGINE MOUNT STUD LOCKNUT	65 N•M	48 FT-LBS
HALF SHAFT TO BRAKE HUB NUT	245 N•M	181 FT-LBS
IDLER PULLEY TO TIMING COVER BOLT	40 N•M	30 FT-LBS
LOWER CASING MOUNTING BOLT	12 N•M	9 FT-LBS
OIL BAFFLE BEARING MOUNTING BOLT	17 N•M	13 FT-LBS
OIL BAFFLE MOUNTING BOLT	12 N•M	9 FT-LBS
OIL PAN DRAIN PLUG	30 N•M	22 FT-LBS
OIL PAN MOUNTING BOLT	12 N•M	9 FT-LBS
OIL PUMP COVER BOLT	12 N•M	9 FT-LBS
OIL PUMP SPROCKET BOLT	6 N•M	53 IN-LBS
OIL PUMP SUMP TO BLOCK BOLT	12 N•M	9 FT-LBS
POWER STEERING PUMP FRONT BRACKET/REAR BRACKET NUT	40 N•M	30 FT-LBS
POWER STEERING PUMP FRONT BRACKET/TIMING CASE BOLT	27 N•M	20 FT-LBS
POWER STEERING PUMP REAR MOUNTING BRACKET STUD BOLT	40 N•M	30 FT-LBS
POWER STEERING PUMP REAR MOUNTING BOLT	27 N•M	20 FT-LBS
REAR CUSHION TO SUPPORT BRACKET BOLT	67 N•M	49 FT-LBS
REAR CUSHION TO EXHAUST BRACKET BOLT	31 N•M	23 FT-LBS
ROCKER SHAFT LOCK BOLT	6 N•M	53 IN-LBS
SPLASH SHIELD (UNDERBODY) BOLT	28 N•M	21 FT-LBS
STARTER MOTOR MOUNTING BOLT	42 N•M	31 FT-LBS
STEERING KNUCKLE NUT AT STRUT	167 N•M	123 FT-LBS

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COMPONENT	TORQUE	
TIMING CASE COVER BOLT	12 N•M	9 FT-LBS
TIMING CHAIN GUIDE MOUNTING BOLT	6 N•M	53 IN-LBS
TIMING CHAIN TENSIONER MOUNTING BOLT	6 N•M	53 IN-LBS
TIMING CHAIN TENSIONER SHOE BOLT	12 N•M	9 FT-LBS
TORQUE CONVERTER TO DRIVE PLATE BOLT	33 N•M	24 FT-LBS
TRANSAXLE MOUNTING BOLT AND ALIGNMENT STUD	65 N•M	48 FT-LBS
TRANSAXLE SUPPORT BRACKET STUD NUT	40 N•M	30 FT-LBS
WHEEL LUG NUT	85 N•M	63 FT-LBS

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Sealer Specifications

SEALER	LOCATION
JEEP/EAGLE GASKET-IN-A-TUBE	• CYLINDER BLOCK TO LOWER CASING MATING SURFACES. • CYLINDER BLOCK TO TIMING COVER BELOW GASKET AT CYLINDER HEAD COVERS.
LOCTITE 242	• CAMSHAFT COVER PLATE ATTACHING BOLTS AT REAR OF CYLINDER HEAD. • FRONT COVER — 4 BOTTOM BOLTS.
LOCTITE 271	• CRANKSHAFT PULLEY NUT. • OIL FILTER ADAPTER. • OIL PUMP SPROCKET MOUNTING BOLTS.
LOCTITE 277	• CYLINDER HEAD EXPANSION (FREEZE) PLUGS. • CYLINDER BLOCK OIL GALLEY EXPANSION PLUGS. • ROCKER ARM SHAFT EXPANSION PLUGS.
LOCTITE 592	• TIMING COVER PIPE PLUG (ACCESS TO RIGHT SIDE CAMSHAFT SPROCKET BOLT).
SUPER OIL CONDITIONER	• ROCKER ARM PADS. • CAMSHAFT JOURNALS.

E8909-396

EXHAUST SYSTEM AND INTAKE MANIFOLD

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GENERAL INFORMATION

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EXHAUST SYSTEM

The exhaust system consists of a front exhaust downpipe, catalytic converter, intermediate pipe and muffler.

WARNING: IF TORCHES ARE USED WHEN WORKING ON THE EXHAUST SYSTEM, DO NOT ALLOW THE FLAME NEAR THE PLASTIC FUEL LINES.

The Premier engines use a single muffler exhaust system with a single monolithic-type catalytic converter.

The exhaust system must be properly aligned to prevent stress, leakage, and body contact. If the system contacts any body panel, it may amplify objectionable noises originating from the engine or body.

When inspecting an exhaust system, critically inspect for cracked or loose joints, stripped screw/bolt threads, corrosion damage, and worn, cracked or broken hangers. Replace all components that are badly corroded or damaged. Do not attempt to repair.

CATALYTIC CONVERTERS

The stainless steel catalytic converter body is designed to last the life of the vehicle. Excessive heat can result in bulging or other distortion, but excessive heat will not be the fault of the converter. A fuel system, air injection system or ignition system malfunction that permits unburned fuel to enter the converter will usually cause overheating. If a converter is heat-damaged, correct the cause of the damage at the same time the converter is replaced. Also, inspect all other components of the exhaust system for heat damage.

Unleaded gasoline must be used to avoid poisoning the catalyst core.

HEAT SHIELDS

Heat shields are needed to protect both the car and the environment from the high temperatures developed in the vicinity of the catalytic converter. The combustion reaction facilitated by the catalyst releases additional heat in the exhaust system. Under severe operating conditions, the temperature increases in the area of the reactor. Such conditions can exist when the engine misfires or otherwise does not operate at peak efficiency. **Do not** remove spark plug wires from plugs or by any other means short out cylinders. Failure of the catalytic converter can occur due to a temperature increase caused by unburned fuel passing through the converter.

Do not allow the engine to operate at fast idle for extended periods (over five (5) minutes). This condition may result in excessive temperatures in the exhaust system and on the floor pan.

EXHAUST GAS RECIRCULATION (EGR)

To assist in the control of oxides of nitrogen (NOx) in engine exhaust, all engines are equipped with an exhaust gas recirculation (EGR) system (Fig. 1). The use of inert exhaust gas to dilute incoming air/fuel mixtures lowers peak flame temperature during combustion, thus limiting the formation of NOx.

Exhaust gases are routed through a tube from the exhaust manifold to the intake manifold adaptor. Where they are metered by the EGR valve into the intake system. Refer to Section 25, "Emission Control Systems" for a complete description, diagnosis and the proper service procedures.

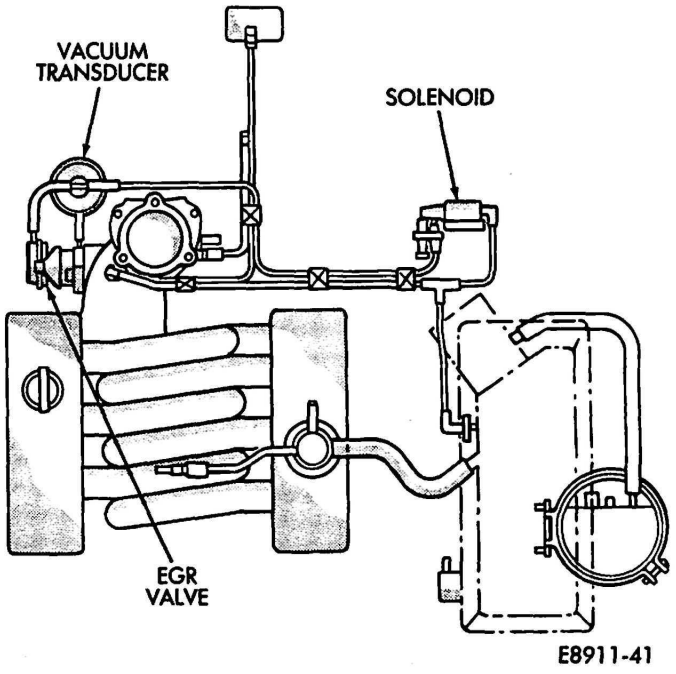


Fig. 1—EGR System (3.0L Engine) Automatic Transmission

SERVICE PROCEDURES

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Intake Manifold—3.0L	7
Intermediate Pipe	6
Muffler	7

EXHAUST MANIFOLDS—3.0L

Removal—3.0L

(1) Position the vehicle on a swing arm hoist. Position the arms under the vehicle on the points shown (Fig. 2).

(2) Disconnect the battery negative cable.

(3) Disconnect the EGR tube from the right hand side exhaust manifold. (If so equipped).

(4) Raise the vehicle on the hoist.

(5) Disconnect the catalytic converter from the Y-pipe by removing the mounting nuts (Fig. 10). Pull the converter back and out of the hanger.

(6) Disconnect the Oxygen (0_2) sensor electrical connector (Fig. 3).

(7) Remove the two (2) small bolts and the large through bolt securing the Y-pipe C-bracket to the transaxle rear mounting bracket.

(8) Remove the nuts securing the Y-pipe flanges to the exhaust manifolds. Pull the Y-pipe back and away from the exhaust manifolds.

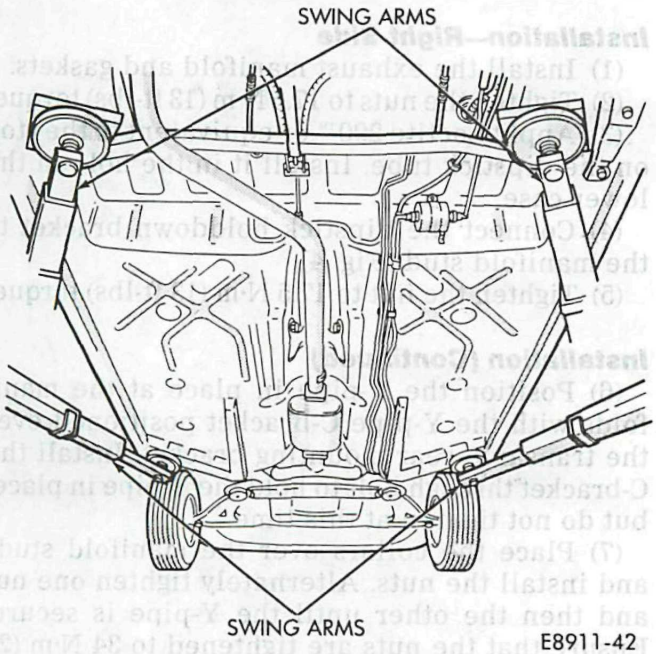


Fig. 2—Side Mounted Swing Arm Hoist

Removal—Right Side

(9) Remove exhaust manifold nut securing the dipstick tube to the exhaust manifold (Fig. 4).

(10) Grasp the dipstick tube and twist it gently back and forth. This will break the seal around the tube. Carefully pull the tube up and out of the lower casing.

(11) Remove the remaining exhaust manifold mounting nuts. Remove the manifold and gasket.

Removal—Left Side

(9) Remove hot air tube heat stove (Fig. 5).

(10) Disconnect the starter wires and ground cable (Fig. 5).

(11) Unscrew the lower exhaust manifold mounting nuts and remove starter heat shield (Fig. 5).

(12) Unscrew the remaining exhaust manifold mounting nuts.

(13) Remove the exhaust manifold and gaskets.

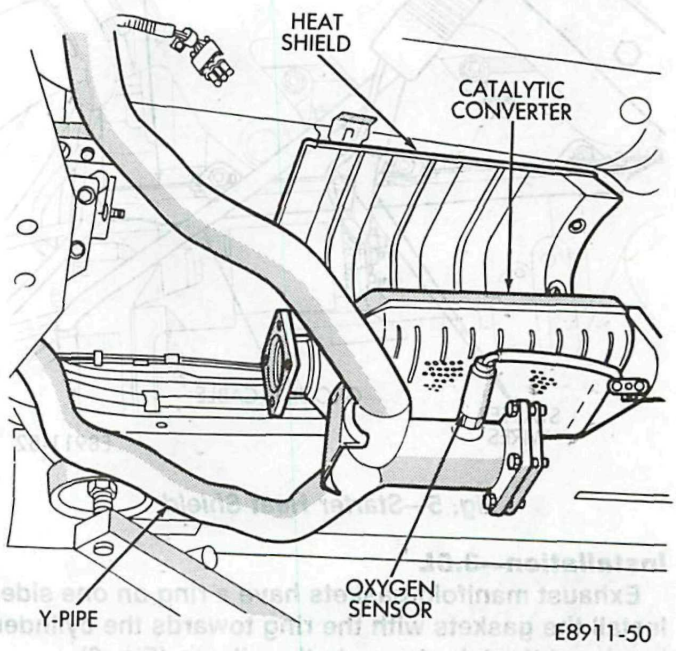


Fig. 3—Catalytic Converter and Y-pipe

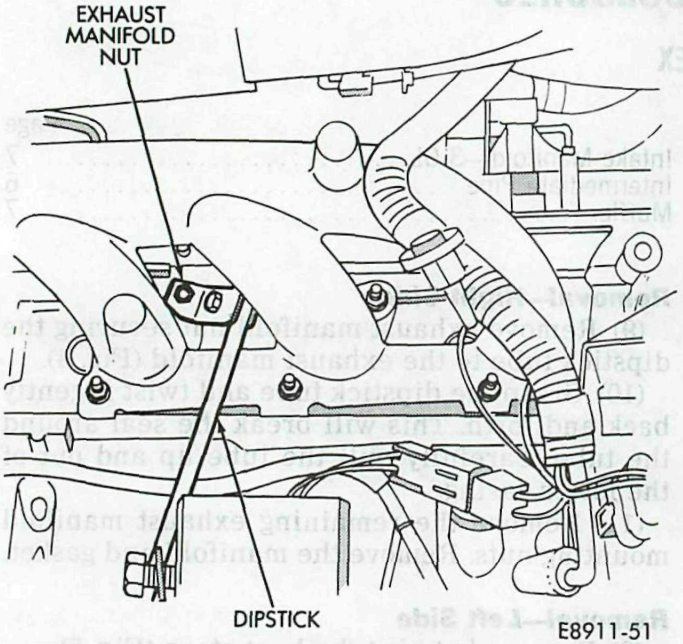


Fig. 4—Dipstick Removal/Installation

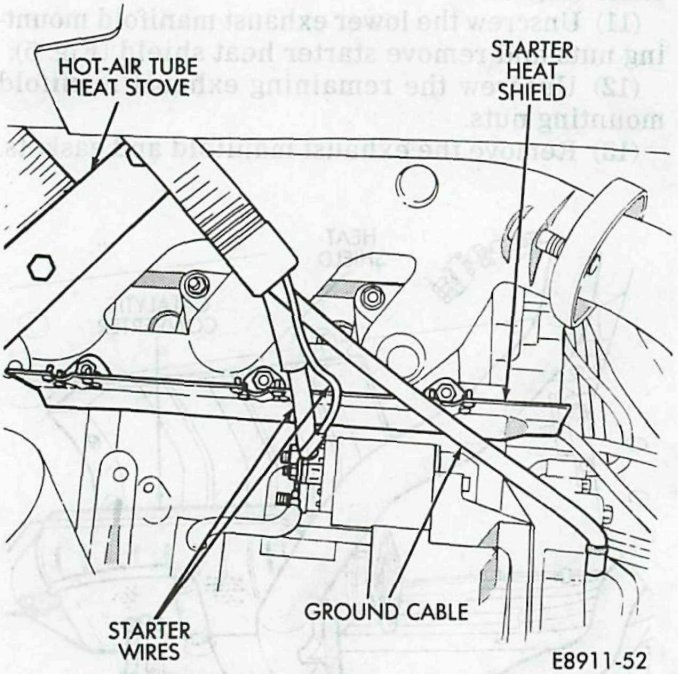


Fig. 5—Starter Heat Shield

Installation—3.0L

Exhaust manifold gaskets have a ring on one side. Install the gaskets with the ring towards the cylinder head and the tabs towards the oil pan (Fig. 6).

Installation—Left Side

(1) install the exhaust manifold and gasket over the studs.

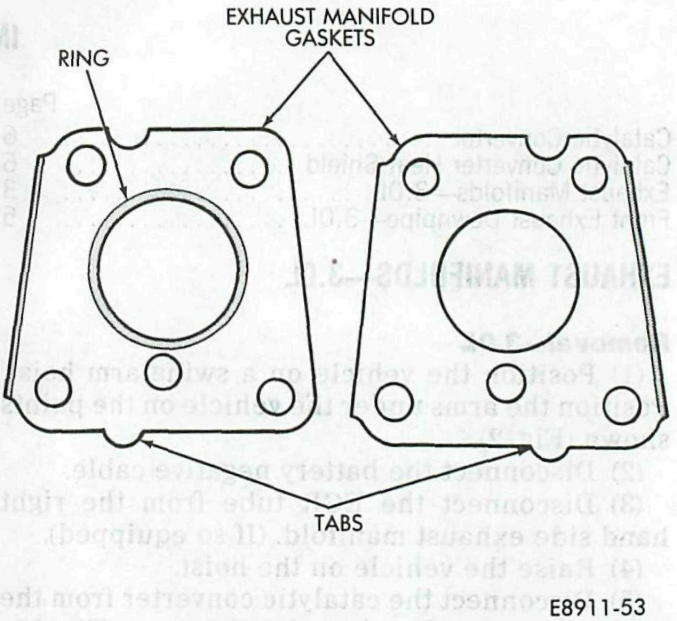


Fig. 6—Exhaust Manifold Gaskets

(2) Install the starter heat shield over the bottom stud (Fig. 5).

(3) Install washers and nuts. Tighten the nuts to 17.5 N·m (13 ft-lbs) torque.

(4) Install the starter motor wires and ground cable.

(5) Install the hot air tube heat stove. Tighten the bolts to 19 N·m (14 ft-lbs).

Installation—Right Side

(1) Install the exhaust manifold and gaskets.

(2) Tighten the nuts to 17.5 N·m (13 ft-lbs) torque.

(3) Apply Loctite 290™ or equivalent to the stop on the dipstick tube. Install it in the hole in the lower case.

(4) Connect the dipstick holddown bracket to the manifold stud (Fig. 4).

(5) Tighten the nut to 17.5 N·m (13 ft-lbs) torque.

Installation (Continued)

(6) Position the Y-pipe in place at the manifolds with the Y-pipe C-bracket positioned over the transaxle rear mounting bracket. Install the C-bracket through bolt to hold the Y-pipe in place, but do not tighten at this time.

(7) Place the collars over the manifold studs and install the nuts. Alternately tighten one nut and then the other until the Y-pipe is secure. Ensure that the nuts are tightened to 34 N·m (25 ft-lbs) torque.

(8) Clean both mating surfaces of the catalytic converter and the Y-pipe. Replace the gasket that goes between the catalytic converter and the Y-pipe.

(9) Connect the catalytic converter to the Y-pipe. Tighten the nuts to 34 N·m (25 ft-lbs) torque.

(10) Tighten the through bolt (C-bracket to transaxle mount) to 68 N·m (50 ft-lbs) torque and the two (2) small bolts to 34 N·m (25 ft-lbs) torque.

(11) Connect the O_2 sensor electrical connector.

(12) Lower the vehicle.

(13) Replace the EGR tube to manifold gasket. Clean both mating surfaces. (If so equipped.)

(14) Connect the EGR tube to the right hand side exhaust manifold with new gasket. Tighten the mounting bolts to 19 N·m (14 ft-lbs) torque.

(15) Connect the battery negative cable.

(16) Start the vehicle and check for leaks.

FRONT EXHAUST DOWNPIPE—3.0L

The front exhaust downpipe is held in place by a welded bracket that connects it to the transmission crossmember. Collars on each arm of the downpipe keep the flared ends of the downpipe secured to the exhaust manifold.

Removal—3.0L

(1) Disconnect the Oxygen (O_2) sensor connector. Remove the O_2 sensor from the front exhaust downpipe (Fig. 7).

(2) Remove the nuts holding the catalytic converter to the front exhaust downpipe (Fig. 7). Pull the converter back and discard the gasket.

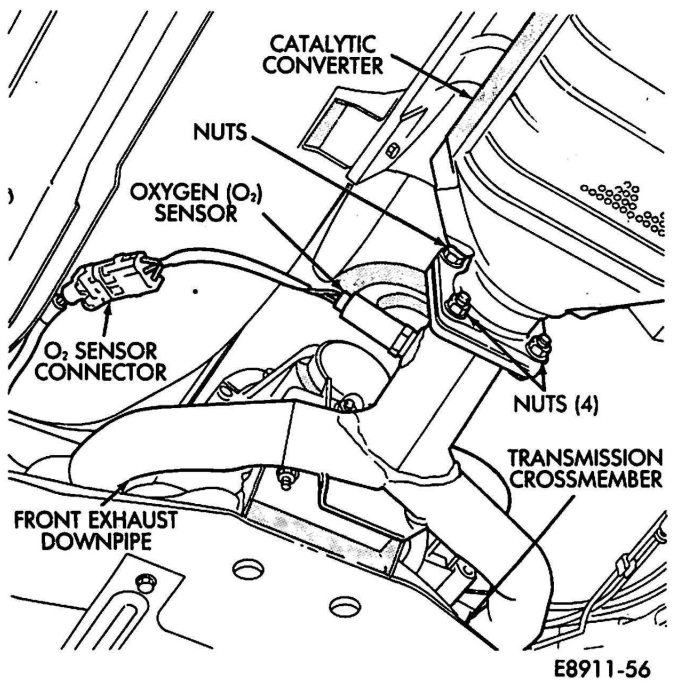


Fig. 7—O_2 Sensor/Catalytic Converter/Exhaust Downpipe

(3) Remove the nuts securing the front exhaust downpipe to the transmission crossmember (Fig. 8).

(4) To remove the front exhaust downpipe it will be necessary to lower the rear of the engine/transaxle/cradle assembly. Place the transmission jack under the transmission crossmember to support the assembly while removing the exhaust downpipe (Fig. 9).

(5) Remove the two rear cradle mounting bolts (Fig. 9).

(6) Lower the transmission jack about 57 mm (2-1/4 inches).

(7) Remove the nuts securing the front exhaust downpipe to the exhaust manifold.

(8) Carefully remove the front exhaust downpipe.

Installation—3.0L

(1) Position the front exhaust downpipe in place at the manifolds and position the support bracket to the transmission crossmember (Figs. 8 and 9).

(2) Tighten the support bracket bolts to 40 N·m (30 ft-lbs) torque.

(3) Tighten the nuts at the collars until the downpipe is secure.

(4) Raise the transmission jack. Install the two rear cradle mounting bolts. Tighten the bolts to 125 N·m (92 ft-lbs) torque.

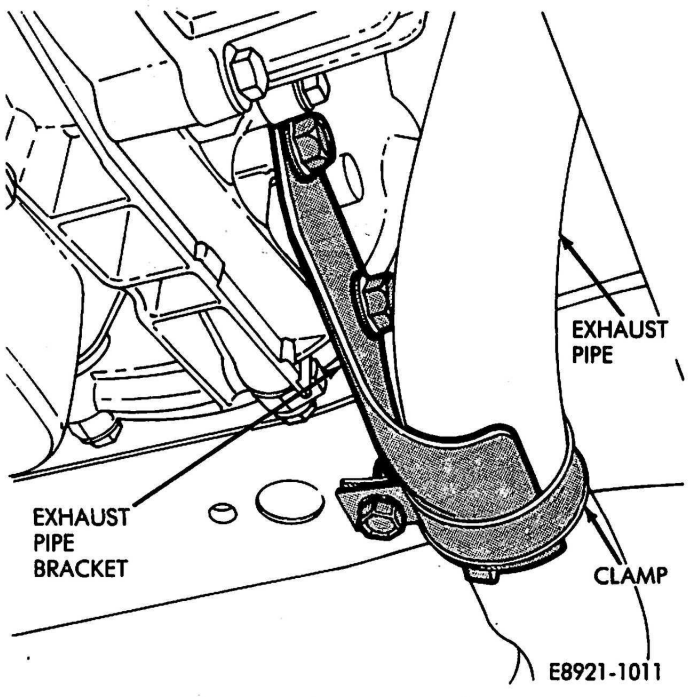


Fig. 8—Exhaust Downpipe Bracket

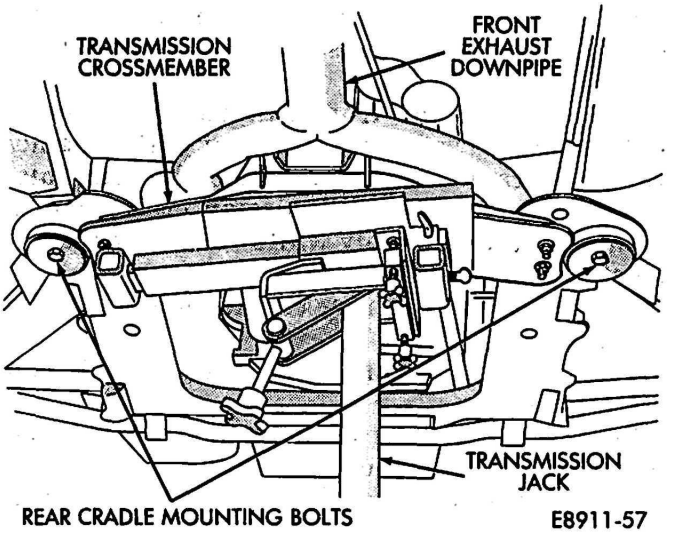


Fig. 9—Support of Transmission Crossmember

(5) Remove the transmission jack.
(6) Replace the front exhaust downpipe to catalytic converter gasket.
(7) Connect the catalytic converter to the front exhaust pipe (Fig. 7). Tighten the nuts to 34 N·m (25 ft-lbs) torque.
(8) Install O_2 sensor (Fig. 7). Tighten the O_2 sensor to 30 N·m (22 ft-lbs) torque.
(9) Connect the O_2 sensor connector.

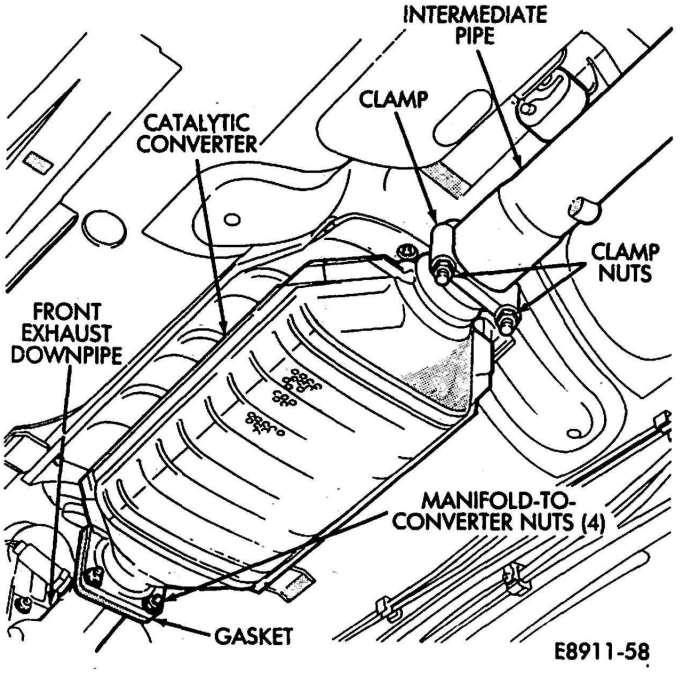


Fig. 10—Intermediate Pipe and Catalytic Converter

CATALYTIC CONVERTER

Removal

(1) Remove the clamp securing the intermediate pipe to the catalytic converter (Fig. 10).
(2) Remove the intermediate pipe from the converter.
(3) Disconnect the converter from the front exhaust downpipe (Fig. 7).

Installation

(1) Replace the front exhaust downpipe to converter gasket.
(2) Connect the converter to the front exhaust downpipe (Fig. 7). Tighten the nuts to 34 N·m (25 ft-lbs) torque.
(3) Connect the intermediate pipe to the catalytic converter (Fig. 10). Tighten the clamp nuts to 61 N·m (40 ft-lbs) torque.

CATALYTIC CONVERTER HEAT SHIELD

Removal

(1) Disconnect the catalytic converter from the front exhaust downpipe (Fig. 7).
(2) Remove the intermediate pipe from the exhaust hanger (Fig. 11).
(3) Loosen the heat shield mounting screws and remove the shield (Fig. 12).

Installation

(1) Install the heat shield (Fig. 12). Tighten the heat shield mounting screws.
(2) Hang the intermediate pipe into the exhaust hanger (Fig. 11).
(3) Connect the catalytic converter to the front exhaust downpipe (Fig. 7).

INTERMEDIATE PIPE

Removal

(1) Remove the clamp securing the intermediate pipe to the catalytic converter (Fig. 13).
(2) Remove the clamp nuts and clamp at the muffler end of the intermediate pipe (Fig. 14).

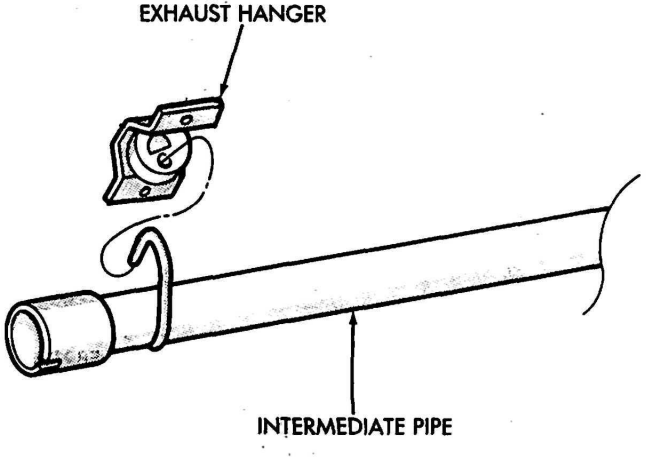


Fig. 11—Intermediate Pipe Removal/Installation

(3) Separate the intermediate pipe from the muffler and from the converter.
(4) Remove the pipe from the hangers (Fig. 14).

Installation

(1) Position the intermediate pipe on the hangers and between the muffler and the catalytic converter.
(2) Connect the intermediate pipe to the converter and secure with the clamp (Fig. 13). Tighten the clamp nuts to 61 N·m (40 ft-lbs) torque.

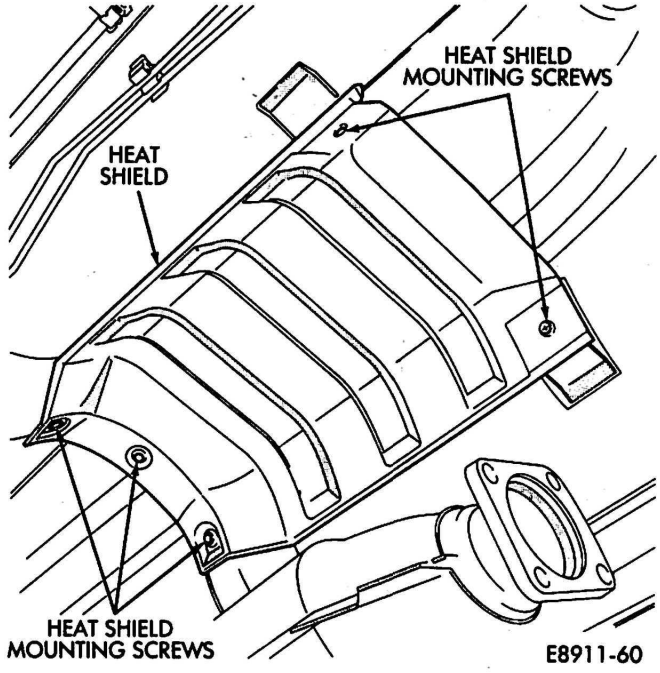


Fig. 12—Heat Shield Removal/Installation

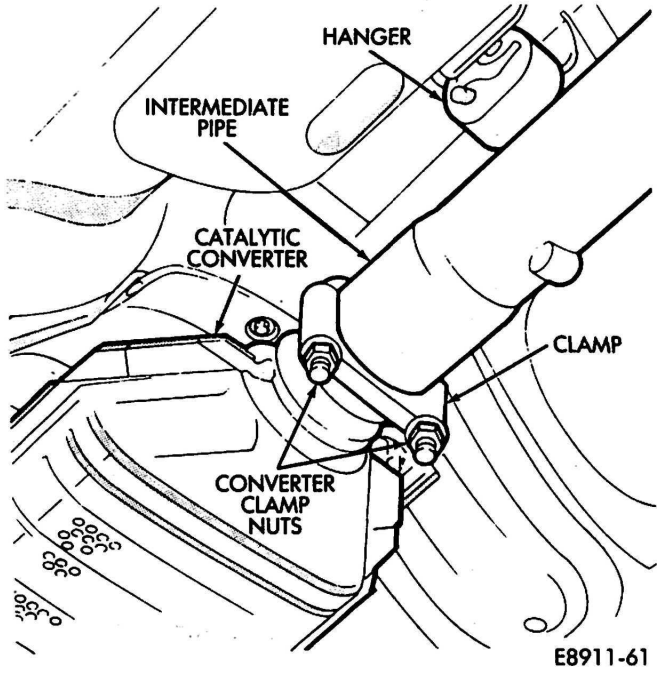


Fig. 13—Intermediate Pipe and Catalytic Converter

(3) Connect the intermediate pipe to the muffler (Fig. 14). Secure with clamp and nuts. Tighten the muffler clamp nuts to 45 N·m (33 ft-lbs) torque.

MUFFLER

Removal

(1) Remove the muffler to intermediate pipe clamp and nuts (Fig. 14).
(2) Remove the muffler from the hanger.
(3) Separate the muffler from the intermediate pipe.

Installation

(1) Install the muffler on the intermediate pipe.
(2) Install the muffler to the hanger.
(3) Install the intermediate pipe clamp at the muffler (Fig. 14). Tighten the nuts to 45 N·m (33 ft-lbs) torque.

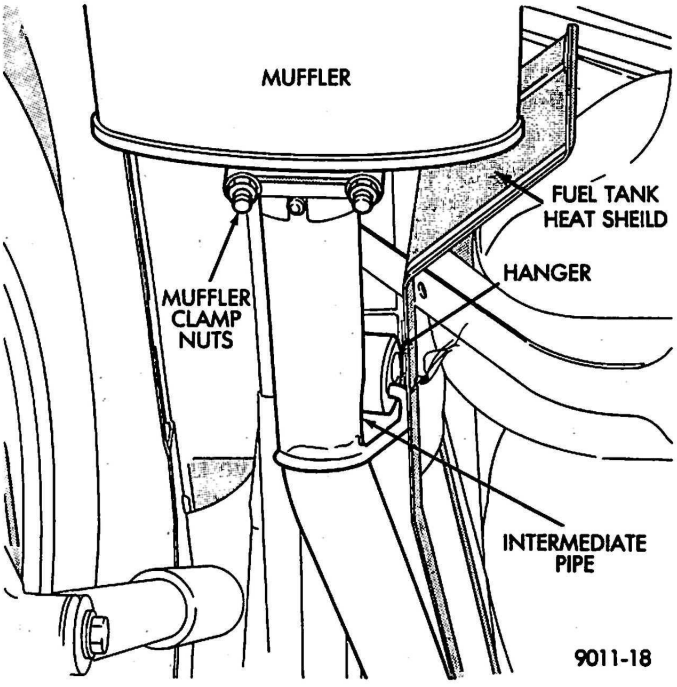


Fig. 14—Intermediate Pipe and Muffler

INTAKE MANIFOLD 3.0L

Removal—3.0L

(1) Remove the battery negative cable.
(2) Remove the throttle body bonnet (Fig. 1).
(3) Disconnect the transmission kick-down cable at the throttle body (Fig. 1).
(4) Disconnect the accelerator cable and cruise control cable connector (Fig. 1).
CAUTION: Use finger pressure only to remove the cruise control connector. If the connector is broken, the whole cable must be replaced.
(5) Disconnect the brake vacuum booster hose (Fig. 2).

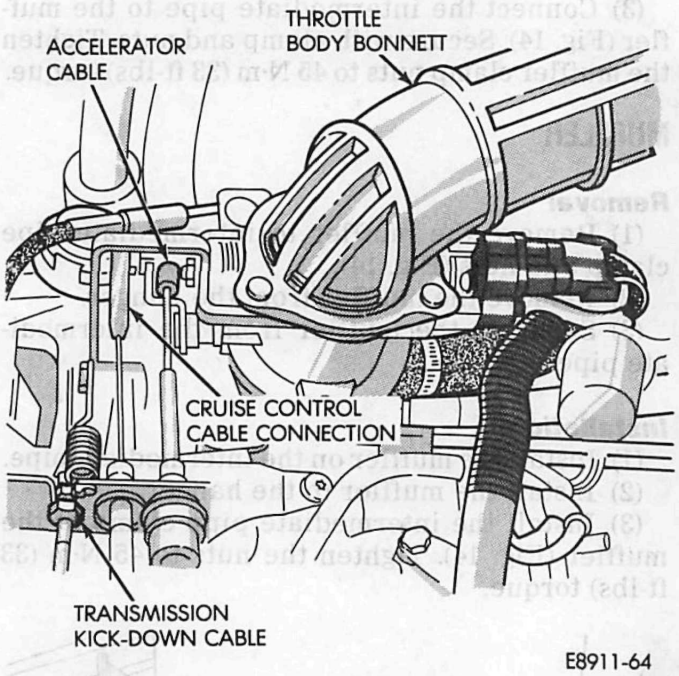


Fig. 1—Removing/Installing Bonnet and Throttle Controls

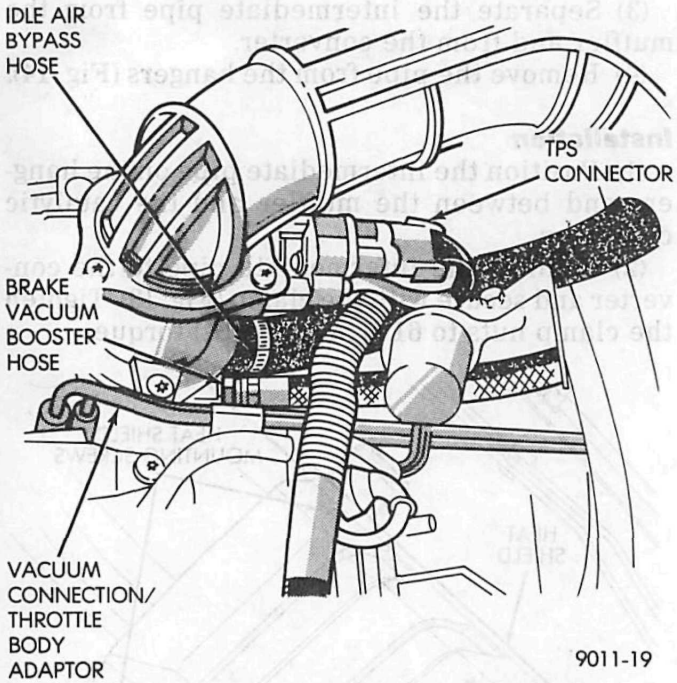


Fig. 2—Vacuum Hoses/TPS Connector/Idle Air Bypass Hose

(6) Disconnect the vacuum connection from the throttle body adapter (Fig. 2).

(7) Disconnect the Throttle Position Sensor (TPS) connector (Fig. 2).

(8) Disconnect the idle air bypass hose from the throttle body adapter (Fig. 2).

(9) Disconnect the Hevac reservoir vacuum hose from the fitting on the throttle body adapter.

(10) Disconnect the EGR tube.

(11) Disconnect the EGR valve transducer vacuum hose (Fig. 3).

(12) Disconnect the air temperature sensor wire connector (located behind the idle air bypass hose).

(13) Before disconnecting the fuel injector wire harness, tag each connector with the number of its corresponding injector.

(14) Disconnect the fuel injector wire harness from the injectors and lay to the side (Fig. 4).

(15) Disconnect the CCV vacuum hose from the fitting between Nos. 2 and 3 runners (Fig. 4).

(16) Remove the fuel tank filler cap to relieve the fuel tank pressure.

(17) Install the fuel tank filler cap.

(18) Place shop towels under the fuel tubes. Disconnect the fuel supply tube from the fuel rail and the fuel return tube from the fuel pressure regulator using disconnect tool 6182 (Fig. 5). Slide the tool onto the nipple and push it forward into the quick-connector until the handle stops on the connector casing. Pull the fuel tubes off.

(19) Move the tubes to the side being careful not to kink the fuel tubes.

(20) Loosen the intake manifold mounting bolts (Fig. 6).

(21) Remove the intake manifold.

(22) Remove and replace the O-rings in the cylinder heads.

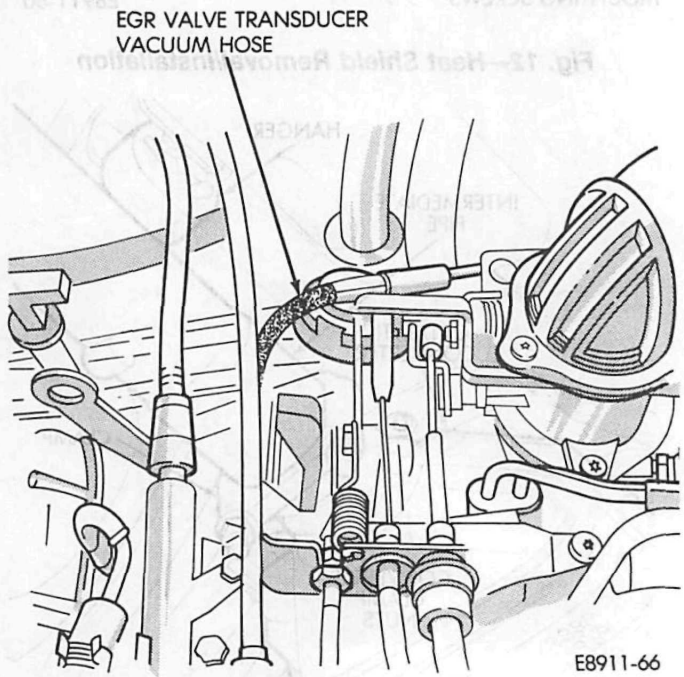


Fig. 3—EGR Valve Transducer Vacuum Hose

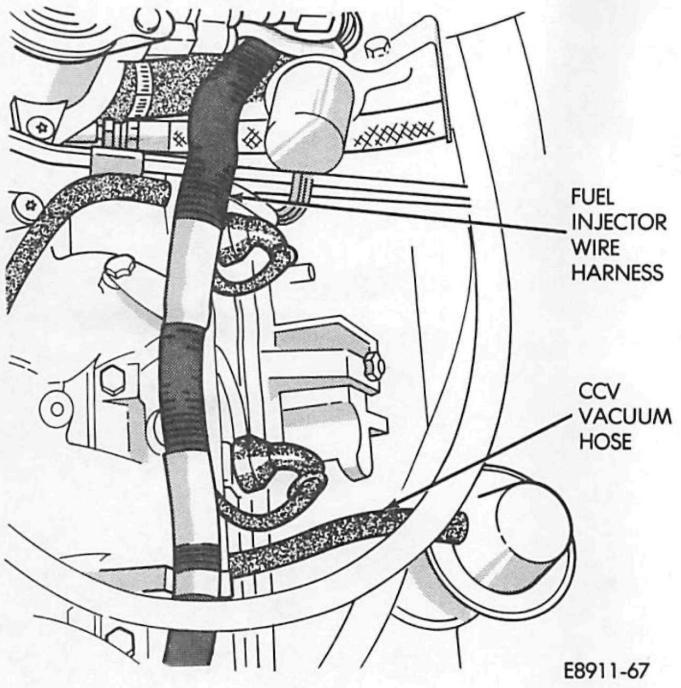


Fig. 4—Injector Harness and CCV Vacuum Hose

Installation—3.0L

(1) Install new O-rings in the cylinder head (Fig. 7). The original O-rings must not be reused.

(2) Install the intake manifold. Tighten the intake manifold bolts to 15 N·m (11 ft-lbs) torque.

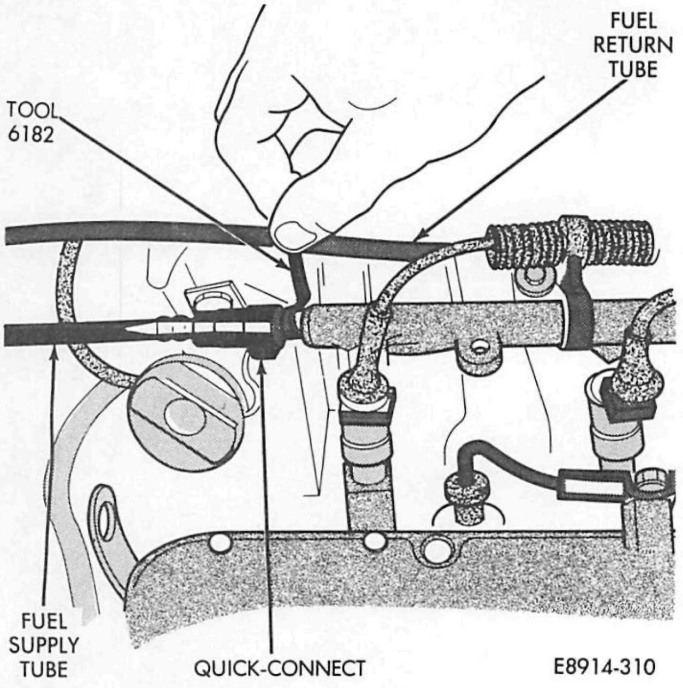


Fig. 5—Disconnect Fuel Lines Using Disconnect Tool 6182

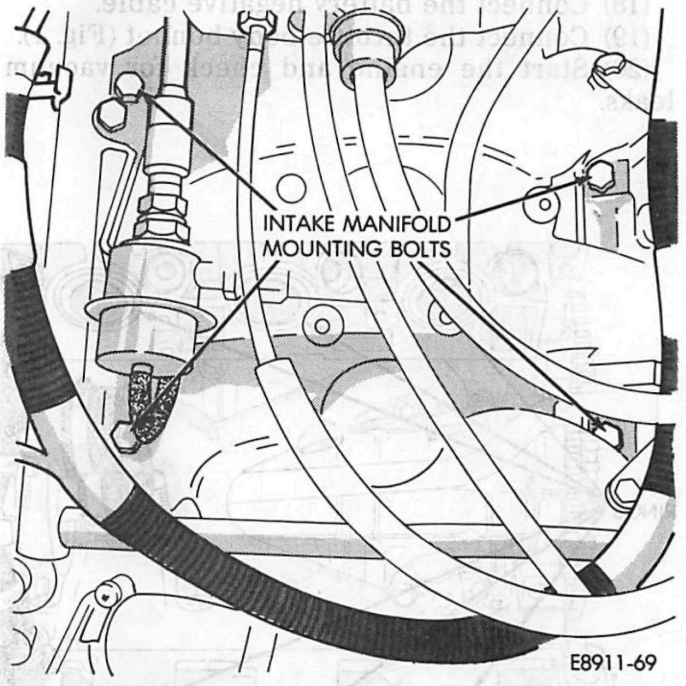


Fig. 6—Intake Manifold Mounting Bolts

(3) Push the fuel supply tube over the fuel rail nipples until a click is heard. Pull back to ensure the connector is locked in place.

(4) Push the fuel return tube over the fuel pressure regulator nipples until a click is heard. Pull back to ensure the connector is locked in place.

(5) Connect the CCV vacuum hose (Fig. 4).

(6) Connect the fuel injector wire harness to the injectors (Fig. 4).

(7) Connect the air temperature sensor wire connector.

(8) Connect the Hevac vacuum reservoir hose to the fitting on the throttle body adapter.

(9) Connect the air idle bypass hose (Fig. 2) to the throttle body adapter.

(10) Connect the TPS electrical connector (Fig. 2).

(11) Connect the vacuum hose to the EGR valve transducer (Fig. 3).

(12) Connect the vacuum connector to the throttle body adapter (Fig. 2).

(13) Connect the EGR tube.

(14) Connect the brake vacuum booster hose (Fig. 2).

(15) Connect the accelerator cable (Fig. 1).

(16) Connect the cruise control cable (Fig. 1), if equipped.

(17) Connect the transmission down-kick cable (Fig. 1). Refer to Group 21, "Transaxle" for the adjustment.

(18) Connect the battery negative cable.
(19) Connect the throttle body bonnet (Fig. 1).
(20) Start the engine and check for vacuum leaks.

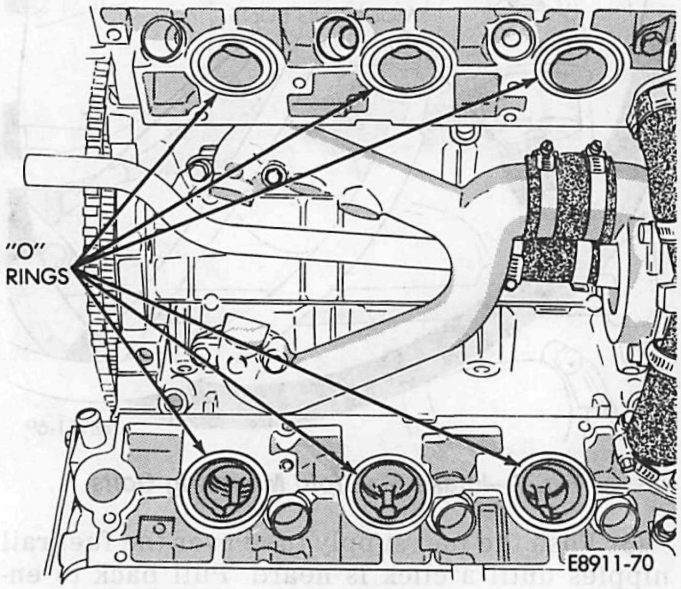


Fig. 7—O-Rings in Cylinder Head

BODY AND FRAME ALIGNMENT

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GENERAL INFORMATION

Because of unibody construction, the vehicles in this Service Manual do not have a conventional frame to which the body was bolted.

Special high strength steels and coated metals were developed to save weight and to have the necessary strength to handle the forces required of structural parts. These parts give the unibody its strength.

A vehicle with unibody construction reacts differently than a vehicle with a frame.

While damage at the point of impact can easily be seen, the rest of the damage must be systematically examined.

There are five (5) logical areas in analyzing damage to a vehicle with unibody construction.

(1) Where vehicle was hit (primary area).
(2) Other body damage (secondary damage).
(3) Mechanical components.
(4) Interior trim and accessories.
(5) Exterior trim and components.

Usually in making a repair, you do things in reverse order of the collison. You must use a logical approach.

When you have collision damage on a unibody vehicle, the critical control points must be brought back to manufacturers specifications. This means:

(1) Accurate measuring.
(2) Measure often.
(3) Recheck your measurements.

You can do the job right the first time if you do the basic structural details of unibody construction and the basic steps that must be performed to repair collision damage.

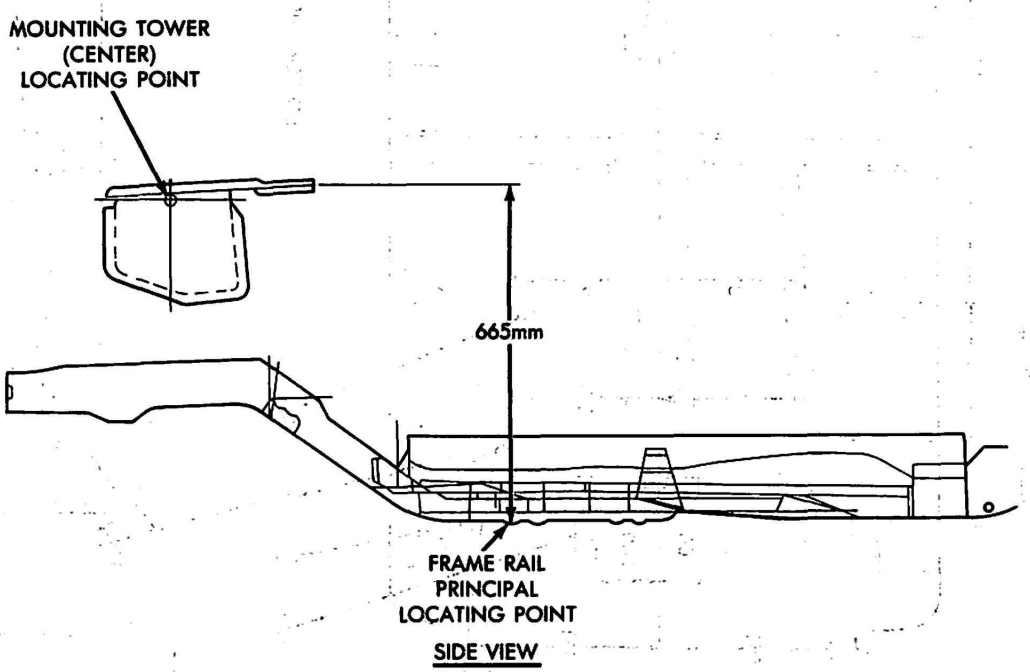


Fig. 1—Mounting Tower (Upper Strut) Locations

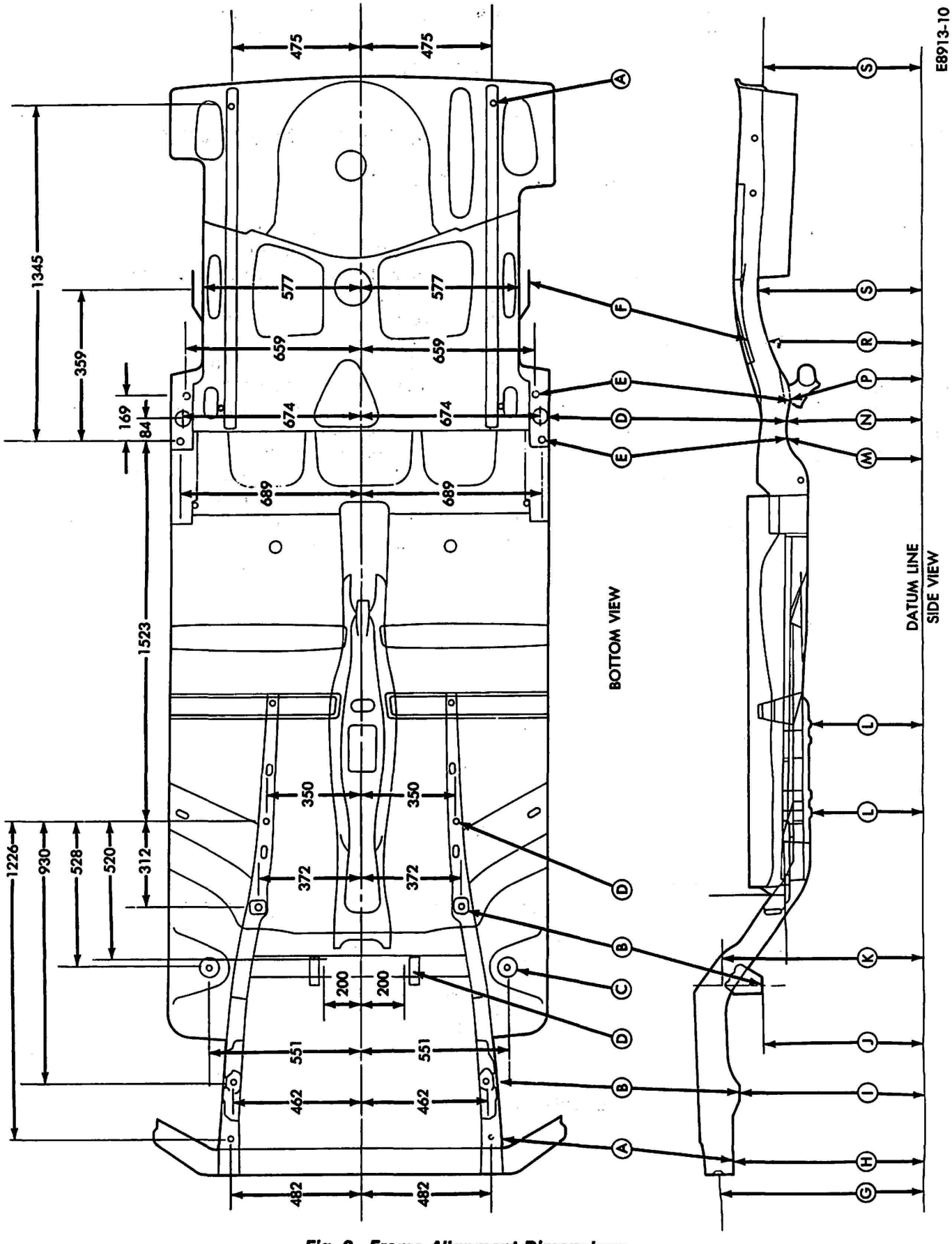


Fig. 2—Frame Alignment Dimensions

Ⓐ ENERGY ABSORBER MOUNTING HOLE
Ⓑ ENGINE CRADLE MOUNTING HOLE
Ⓒ STRUT TOWER HOLE
Ⓓ MASTER TOOLING HOLE (16.5 mm DIAMETER)
Ⓔ REAR SUSPENSION MOUNTING HOLE
Ⓕ REAR SHOCK ABSORBER MOUNTING HOLE

THE FOLLOWING DIMENSIONS ARE TO THE DATUM LINE.

Ⓖ 524 mm TO CENTER OF ENERGY ABSORBER HOLE
Ⓗ 476 mm TO BOTTOM OF ENERGY ABSORBER MOUNTING HOLE
Ⓘ 293 mm TO BOTTOM OF ENGINE CRADLE MOUNTING HOLE
Ⓙ 308 mm TO BOTTOM OF ENGINE CRADLE MOUNTING HOLE
Ⓚ 569 mm TO STEERING GEAR CROSSMEMBER
Ⓛ 254 mm TO BOTTOM OF FRAME RAIL
Ⓜ 304 mm TO BOTTOM OF REAR SUSPENSION MOUNTING HOLE
Ⓝ 311 mm TO BOTTOM OF MASTER TOOLING HOLE
Ⓟ 318 mm TO BOTTOM OF REAR SUSPENSION MOUNTING HOLE
Ⓡ 498 mm TO CENTER OF REAR SHOCK ABSORBER MOUNTING HOLE
Ⓢ 453 mm TO BOTTOM OF FRAME RAIL

CHRYSLER

FUEL SYSTEM

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GENERAL INFORMATION

The 3.0L engine employs a Multi-Point Fuel Injection (MPI) system. The MPI system injects fuel into the intake manifold above the intake valve port of each cylinder through separate injectors. Refer to MPI section of this group for further information.

The Fuel System consists of the fuel tank, electric fuel pump, fuel filter, fuel tubes, fuel hoses, vacuum hoses, throttle body, and fuel injector(s).

The **Fuel Delivery System** consists of the fuel pump, fuel filter, fuel tubes, and fuel hoses.

A Fuel Return System is used on all vehicles. The system consists of the fuel tubes and hoses that route fuel back to the fuel tank.

The **Fuel Tank Assembly** consists of the fuel tank, filler tube, a fuel gauge sending unit/fuel pump assembly, and a pressure vacuum filler cap.

Also to be considered part of the fuel system is the **Evaporation Control System,** which is designed to reduce the emission of fuel vapors into the atmosphere. The description and function of the Evporative Control System is found in Group 25 of this manual.

WARNING: THE FUEL SYSTEM USED ON THE PREMIER HAS A PLASTIC FUEL TANK AND PLASTIC FUEL TUBES. KEEP OPEN FLAME SUCH AS A CUTTING TORCH AWAY FROM THESE COMPONENTS WHEN SERVICING THE VEHICLE.

Fuel Requirements

Your vehicle was designed to use high quality gasoline. In order to retain the performance qualities of your vehicle and enjoy maintenance free operation, it is recommended that only unleaded gasolines from reputable dealers be used.

Use only unleaded gasolines having a minimum octane rating of 87 (R+M)/2.

Should your vehicle develop spark knock (ping), purchase your fuel from another source. Vehicles may respond differently to gasolines having the same octane rating. Occasional trace knock at low engine speeds is not harmful; however, continued knock at high speeds can damage your engine and should be reported to your dealer immediately. Engine damage as the result of prolonged operation of a vehicle with continuous high speed spark knock may not be covered by the new vehicle warranty.

In addition to using unleaded gasoline with the proper octane rating, gasolines that contain detergent and corrosion control additives are recommended. The use of gasoline containing these additives will help improve fuel economy, reduce emissions and maintain vehicle performance. If in doubt, premium unleaded gasolines generally contain more additive than the regular unleaded gasolines.

Low quality fuel can cause problems such as hard starting, stalling and driveability deterioration. If problems of this type are experienced, it is recommended that another brand of gasoline be used prior to considering service for the vehicle.

The exhaust emission system of your vehicle is designed to meet all emission regulations while, at the same time, providing excellent fuel economy. Catalyst systems require that only unleaded gasoline be used. Use of leaded fuel will not only destroy the effectiveness of the catalytic converter used to reduce exhaust emissions, but will also make part of the fuel control system inoperative and lead to high fuel consumption. All vehicles have warning labels on the instrument panel and adjacent to the fuel filler cap or door that state UNLEADED FUEL ONLY. These vehicles also have fuel filler tubes designed to accept only the unleaded gasoline dispensing nozzle. Damage resulting from the use of leaded gasoline may not be covered by the new vehicle warranty.

GASOLINES CONTAINING ALCOHOL

Your vehicle was designed to obtain the best performance and efficiency using unleaded gasoline. Some fuel suppliers sell gasoline/alcohol blends as a motor fuel. The type and amount of alcohol used in the blend are important. Many states require that the service station pumps dispensing gasoline containing alcohol be properly labeled with the type and amount of alcohol present. If your state does not have this requirement, we recommend that you ask the gasoline station operator if their fuel contains alcohol and if so, what type and amount.

The following two types of alcohols are generally used in gasoline blends:

ETHANOL (Ethyl or Grain Alcohol) is used as a mixture of 10% ethanol and 90% unleaded gasoline and identified as "Gasohol", "Ethanol Enhanced", or "Contains Ethanol". Gasoline blended with ethanol may be used in your vehicle. Note that these blends, due to their generally higher volatility, may adversely affect the starting, driveability and fuel efficiency of your vehicle. If problems are experienced with ethanol/gasoline blends, it is recommended that the vehicle be operated on gasoline.

METHANOL (Methyl or Wood Alcohol) is used in a variety of concentrations blended with unleaded gasoline. You may encounter fuels containing 3% or more methanol along with other alcohols, called cosolvents.

DO NOT USE GASOLINES CONTAINING METHANOL

Use of methanol/gasoline blends may result in starting and driveability deterioration and damage to critical fuel system components.

Fuel system damage and vehicle performance problems resulting from the use of gasolines containing methanol are not the responsibility of Chrysler Corporation and may not be covered by the new vehicle warranty.

GASOLINES CONTAINING MTBE

Gasoline and MTBE (Methyl Tertiary Butyl Ether) blends are a mixture of unleaded gasoline and up to 15% MTBE. Gasoline blended with MTBE may be used in your vehicle.

FUEL DELIVERY SYSTEM

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MPI Fuel System Pressure Test	4

GENERAL INFORMATION

The electric fuel pump is attached to the gauge sender unit. The pump/sender unit is suspended in the fuel tank and immersed in fuel.

A 64.4 liter (17 gallon) capacity, molded fuel tank is used in Premier vehicles. The fuel tank filler door is located on the passengers rear quarter panel. Some models have a remote operated fuel filler door. The release lever is located on the passenger compartment floor to the left of the driver's seat. **If the release lever should malfunction, there is a manual override fuel filler door release in the trunk (Fig. 1).**

Fuel Return System

The fuel return system consists of the tubes that route from the pressure regulator to the fuel tank. On the MPI system used on 3.0L engines, during normal operation, the fuel pump delivers fuel in excess of the maximum required by the engine. The excess fuel flows back to the fuel tank from the pressure regulator via the fuel return tube.

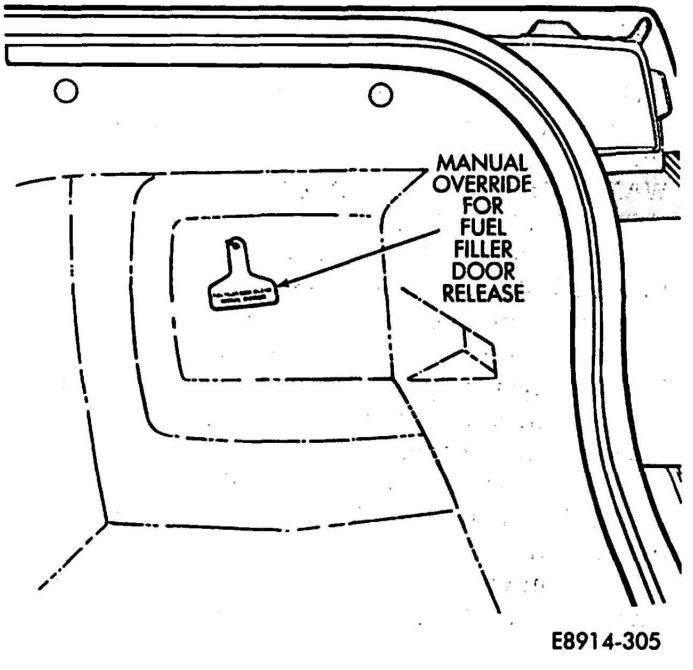


Fig. 1—Remote Operated Fuel Filler Door Manual Override Lever

FUEL PUMP

The fuel pump is a positive displacement, single speed, multi-cell roller type pump driven by a permanent magnet, 12 volt electric motor. The pump is integral with the fuel sender unit. The pump/sender assembly is installed inside the fuel tank. The pump runs whenever the engine is operating.

The fuel pump contains a check valve at the outlet end that consists of a steel ball held against a seat by force applied from a spring. When the pump is operating, fuel pressure overcomes spring pressure and forces the ball off its seat allowing fuel to flow. When the pump is not operating, spring pressure forces the ball back against the seat preventing fuel backflow through the pump. The check valve prevents the system from losing prime when the engine is not operating.

A pressure relief valve inside the pump prevents fuel pressure inside the pump from exceeding approximately 689 kPa (100 psi). Should internal pump pressure reach this range, the relief valve will bypass fuel to the suction side of the pump.

MPI (used on 3.0L engine) system fuel pressure is maintained at 248-255 kPa (36-37 psi) when the pump is operating and vacuum is supplied to the fuel pressure regulator (located on the fuel rail—not the pump's internal pressure regulator). If vacuum is not supplied to the pressure regulator, because of a broken or clogged vacuum line, fuel pressure will be higher.

Fuel Pump Controls

For the 3.0L MPI system, voltage to operate the fuel pump is supplied through the Fuel Pump Relay when the relay is grounded by the Engine Electronic Control Unit (ECU).

MPI FUEL SYSTEM PRESSURE TEST

WARNING: WEAR EYE PROTECTION WHEN SERVICING THE FUEL SYSTEM. DO NOT SMOKE OR ALLOW OPEN FLAME NEAR FUEL SYSTEM COMPONENTS DURING FUEL SYSTEM SERVICE.

(1) Remove the fuel tank filler cap to relieve the fuel tank pressure.

WARNING: SYSTEM FUEL PRESSURE WILL BE RELEASED WHEN DISCONNECTING THE FUEL SUPPLY TUBE. WRAP SHOP TOWELS AROUND THE TUBE AND QUICK-CONNECT FITTING TO ABSORB SPILLED FUEL.

(2) Use tool 6182 to remove the black fuel supply tube from the fuel rail (Fig. 2). Slide the tool over the nipple and up into the connector until the handle fits the connector. Pull the fuel supply tube off the fuel rail.

(3) Install fuel tube adapter, tool number 6175.

(4) Push the female end with the quick-connect fitting over the fuel rail until a click is heard. Pull the connector back to ensure that it is locked in place.

(5) Push the male end with the nipple into the black fuel supply tube until a click is heard. Pull the nipple back to ensure that it is locked in place.

(6) Attach the 0-60 psi gauge from fuel gauge set 5069 or equivalent to the port on fuel tube adapter 6175.

(7) Start the engine and check the fuel pressure. It should be 193-207 kPa (28-30 psi).

The fuel pressure regulator is non-adjustable.

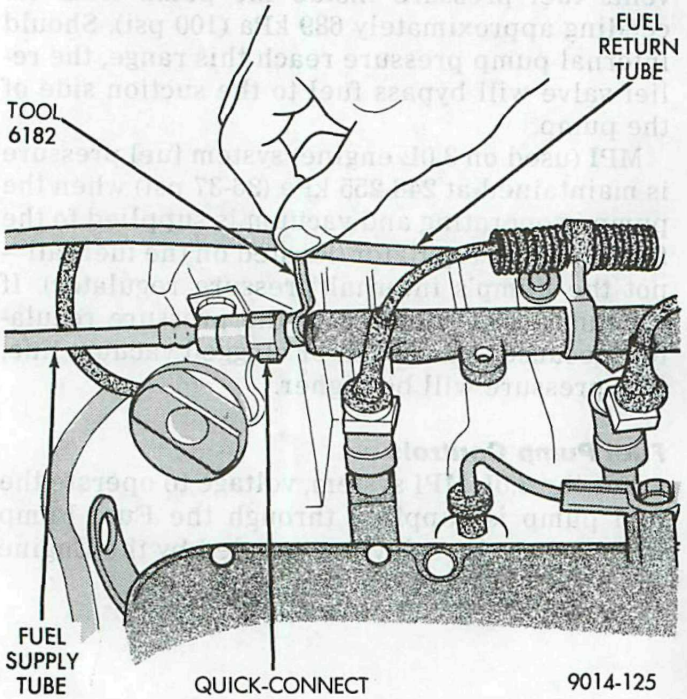


Fig. 2—Disconnecting Fuel Supply Tube at Fuel Rail—MPI

(8) If the fuel pressure is low, check for fuel flow through the return tube.

- If fuel is returning to the fuel tank through the fuel return tube, replace the fuel pressure regulator.
- If fuel is not returning to the fuel tank through the return tube, inspect for a faulty fuel pump, possible clogged fuel filter or other restriction between the fuel pressure regulator and the fuel pump.

(9) If the fuel pressure is high, check the pressure regulator vacuum hose for leaks and for a kink or restriction in the fuel return tube. If the pressure regulator vacuum hose is not leaking and the return tube is not kinked or does not have a restriction, the fuel pressure regulator should be replaced.

(10) Remove the pressure gauge.

(11) Disconnect the fuel tube adaptor 6175 with disconnect tool 6182.

(12) Prior to installing the fuel tubes to the regulator and fuel rail the tube ends **MUST** be lightly lubricated with clean 30 weight engine oil. Refer to Fuel Tubes and Quick-Connect Fittings in this section.

(13) Install the black fuel supply tube to the fuel rail and the grey fuel return tube to the pressure regulator. Refer to Fuel tubes and Quick-Connect Fittings in this section for correct installation procedure.

(14) Install fuel filler cap.

FUEL FILTER

(1) Disconnect negative cable from battery.

(2) Remove the fuel tank filler cap to relieve the fuel tank pressure.

WARNING: WEAR EYE PROTECTION WHEN SERVICING THE FUEL SYSTEM. DO NOT SMOKE OR ALLOW OPEN FLAME NEAR FUEL SYSTEM COMPONENTS DURING FUEL SYSTEM SERVICE.

Wrap shop towels around the fuel line quick-connectors before disconnecting them from the filter. The system pressure will bled off when the quick-connector is removed. The shop towels will prevent fuel spillage.

(4) Depress retainer tabs and slowly pull the connectors from fuel filter. Note that the retainers stay on the fuel filter nipples.

(5) Remove screw holding the fuel filter in place (Fig. 3). Remove fuel filter.

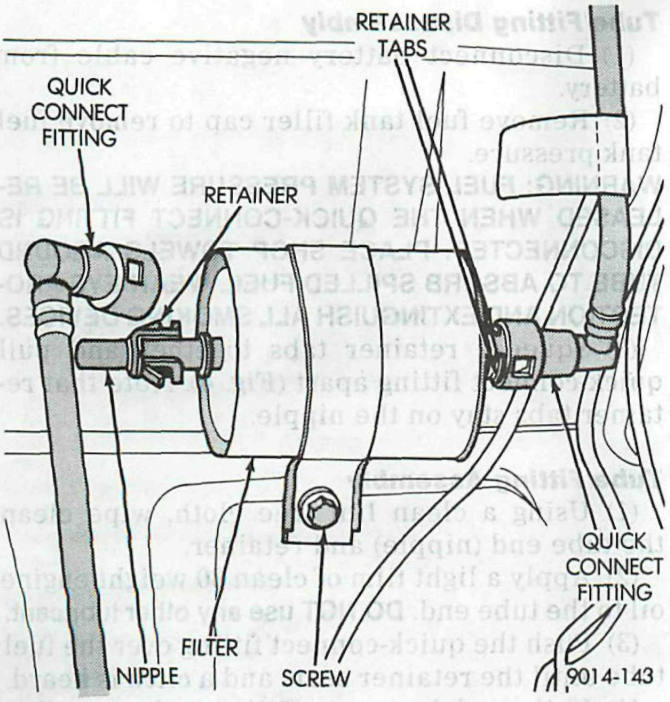


Fig. 3—Fuel Filter Removal/Installation

Carefully remove the retainers from fuel filter nipples with a thin straight blade screwdriver. Insert the screwdriver between the filter nipple and the wedge portion of the retainer that seats against the shoulder on the nipple. Press the wedge back and slip the wedge over the nipple shoulder. Repeat this on the other side of the retainer and then pull the retainer off the nipple.

Push the retainers back into the fuel line quick-connect fittings. *Ensure* that the locking "ears" and the shoulder (stop bead) on the fuel tube are completely visible in the "windows" on the side of the quick-connect fittings.

Installation

The fuel filter is marked IN and OUT at the nipple ends. The side marked IN is connected to the fuel line from the fuel tank. The side of the filter marked OUT is connected to the fuel line that runs to the engine.

(1) Position fuel filter in place. Secure with screw. Tighten screw to 12 N·m (110 in-lbs) torque.

(2) Lightly lubricate the fuel tube ends with clean 30 weight engine oil prior to reinstallation. Refer to Fuel Tubes and Quick-Connect Fittings in this section.

(3) Refer to Fuel Tube and Quick-Connect Fittings in this section for correct quick-connect fitting connection procedures. Connect the fuel line quick-connect fittings to the fuel filter nipples.

(4) Connect negative cable to battery.

(5) Install fuel tank filler cap.

(6) Turn the key to the ON position to pressurize the fuel system and check for leaks.

FUEL TUBES AND QUICK-CONNECT FITTINGS

The fuel system used on this vehicle utilizes plastic fuel tubes with quick-connect fittings that have sealed O-ring seals. The O-rings of the quick-connect fittings do not have to be replaced when the fittings are disconnected.

The quick-connect fitting consists of the O-rings, retainer and casing (Fig. 4). When the fuel tube nipple is inserted into the quick-connect fitting, the shoulder of the nipple is locked in place by the retainer, and the O-rings seal the tube.

The fuel tube nipples must be first lubricated with clean 30 weight engine oil prior to reconnecting the quick-connect fitting.

When the fittings are disconnected the retainer will stay on the nipple of the component that the tube is being disconnected from. A fuel tube should never be inserted into a quick-connect fitting without the retainer being either on the tube or already in the quick-connect fitting. In either case, care must be taken to ensure that the retainer is locked securely into the quick-connect fitting.

If the quick-connect fitting has "windows" in the sides of the casing, the retainer locking "ears" and the shoulder (stop bead) on the tube must be visible in the windows or the retainer is not properly installed (Fig. 5). After connecting a quick-onnect fitting, the connection should be verified by pulling on the lines to ensure that the lock is secure.

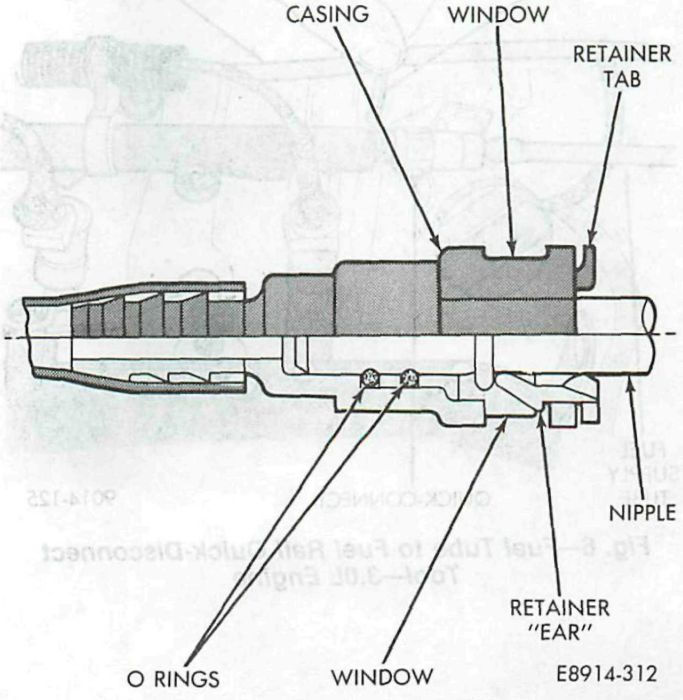


Fig. 4—Quick-Connect Fitting

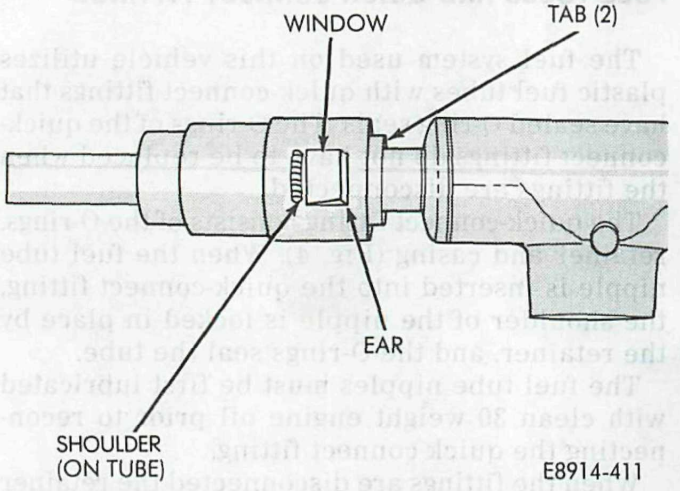


Fig. 5—Correct Quick-Connect Fitting Installation

Fuel tube disconnect tool 6182 can be used at the 3.0L engine fuel rail and fuel pressure regulator to remove the quick-connect fitting and retainer as an assembly (Fig. 6). The retainer will remain in the fitting in the correct position. To install the fuel tube, push it over the nipple until a click is heard. Pull back on the tube to ensure that the connector is locked in place.

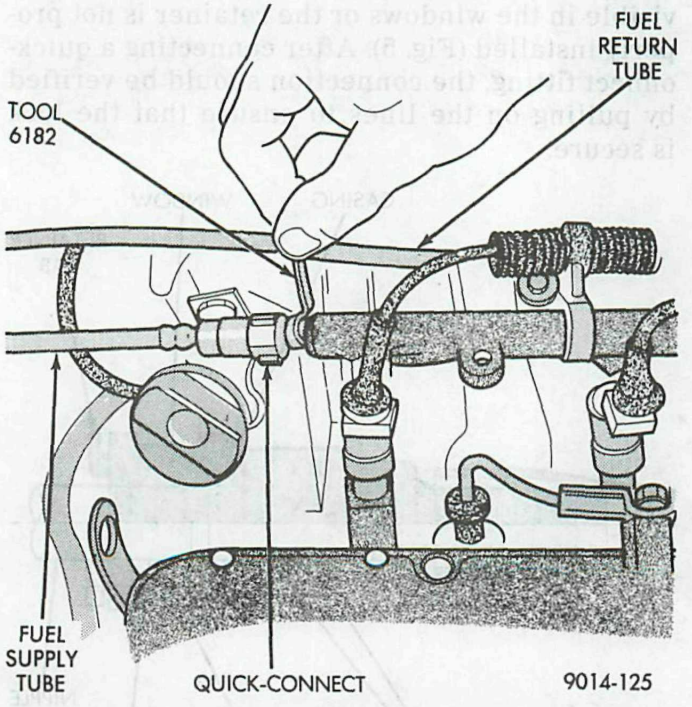


Fig. 6—Fuel Tube to Fuel Rail Quick-Disconnect Tool—3.0L Engine

Tube/Fitting Disassembly

(1) Disconnect battery negative cable from battery.

(2) Remove fuel tank filler cap to remove fuel tank pressure.

WARNING: FUEL SYSTEM PRESSURE WILL BE RELEASED WHEN THE QUICK-CONNECT FITTING IS DISCONNECTED. PLACE SHOP TOWELS AROUND TUBE TO ABSORB SPILLED FUEL. WEAR EYE PROTECTION AND EXTINGUISH ALL SMOKING DEVICES.

(3) Squeeze retainer tabs together and pull quick-connect fitting apart (Fig. 4). Note that retainer tabs stay on the nipple.

Tube/Fitting Assembly

(1) Using a clean lint free cloth, wipe clean the tube end (nipple) and retainer.

(2) Apply a light film of clean 30 weight engine oil to the tube end. **DO NOT use any other lubricant.**

(3) Push the quick-connect fitting over the fuel tube until the retainer seats and a click is heard.

(4) If, the quick-connect fitting is the type that has "windows" on the side, ensure that the locking "ears" on the retainer and the shoulder (stop bead) on the fuel tube are completely visible in the "windows." Do not rely upon the audible click to confirm that a secure connection has been made. Pull back on the quick-connect fitting to further ensure that the connection is complete and the connector is locked in place.

(5) Install fuel tank filler cap.

(6) Connect negative cable to battery.

(7) Turn key to on position. Inspect for leaks.

FUEL TANK

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Fuel Tank Rollover Valve	13
General Information	7
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GENERAL INFORMATION

A 64.4 liter (17 gallon) capacity, molded fuel tank is used in these vehicles. The fuel tank is equipped with fuel and vapor controls that allow the vehicles to pass a 360 rollover without fuel leakage.

An evaporative control system prevents raw fuel vapor from escaping into the atmosphere. Fuel vapor from the fuel tank is collected in an evporative canister. When the engine is operating the vapors are drawn into the intake manifold to be consumed in combustion.

Inspect all hose/clamp connections for completeness and ensure that no leaks are present. Hoses that are cracked, scuffed, swelled, have rubbed against other vehicle components or show any other sign of wear that could lead to failure should be replaced.

When installing hoses, ensure that they are routed away from contact with other vehicle components that could rub against them and cause failure.

No-Lead Fuel Tank Filler Tube

These vehicles are designed to operate using Unleaded fuels. The diameter of the opening in the fuel tank filler neck is sized to only accept unleaded fuel nozzles. Gasoline station pumps for unleaded and leaded fuels have different size nozzles. Leaded fuel nozzles are larger in diameter than unleaded nozzles. The fuel tank filler neck opening is also equipped with a deflector which the smaller unleaded nozzle pushes back upon entering the filler neck. The deflector will prevent the larger diameter leaded fuel nozzles from entering the filler neck and will deflect fuel away from the filler neck if filling of the tank with leaded fuel is attempted.

PRESSURE-VACUUM FILLER CAP

The fuel filler cap incorporates a two-way relief valve that is closed to atmosphere during normal operating conditions. The relief vavle is calibrated to open when a pressure of 10 kPa (1.5 psi) or vacuum of 6 kPa (1.8 in. Hg) occurs in the fuel tank. When the pressure or vacuum is relieved, the valve returns to the normally closed position.

CAUTION: The fuel filler cap must be removed to release fuel tank pressure prior to disconnecting any fuel system component.

FUEL TANK

Draining Fuel Tank

WARNING: GASOLINE IS AN EXTREMELY VOLATILE SUBSTANCE. KEEP OPEN FLAME AND HIGH HEAT AWAY FROM THE FUEL SYSTEM COMPONENTS WHEN SERVICING THE FUEL SYSTEM. WEAR EYE PROTECTION AND EXTINGUISH ALL SMOKING DEVICES WHEN SERVICING THE FUEL TANK

(1) Disconnect battery negative cable.

(2) Remove fuel filler cap.

(3) Using a portable gasoline siphon/storage tank drain the fuel tank until dry.

Removal

(1) Disconnect the battery negative cable.

(2) Remove the fuel tank filler cap to relieve the fuel tank pressure.

(3) Drain the fuel tank. Refer to Draining Fuel Tank.



Fig. 7—Ground Wire

(4) Raise the vehicle on a hoist (Refer to Engine/Transmission/Cradle Removal/Installation Section—Vehicle Lifting Information).

(5) Remove the right rear tire and wheel.

(6) Remove the splash shield from the wheel well.

(7) Remove ground wire retaining screw (Fig. 7).

(8) Loosen hose clamp and disconnect fuel tank vent hose from fuel tank filler neck (Fig. 8).

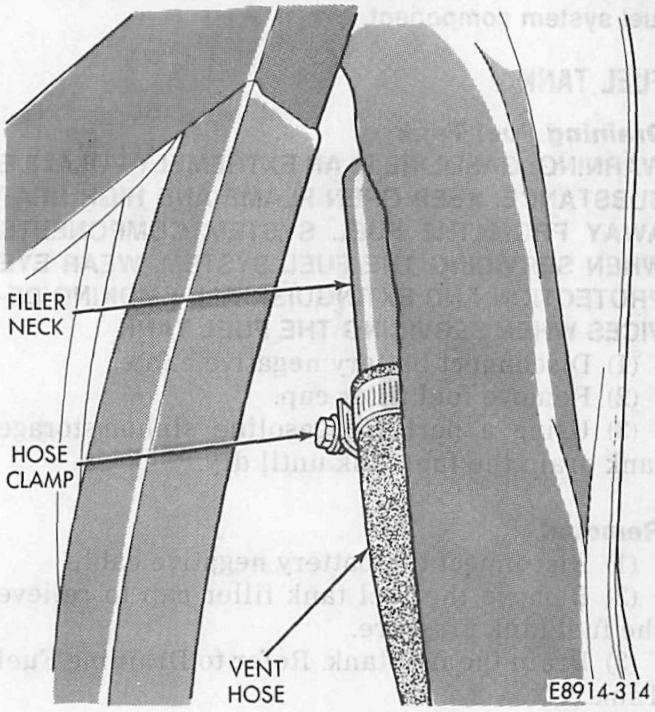


Fig. 8—Fuel Filler Vent Hose Removal/Installation

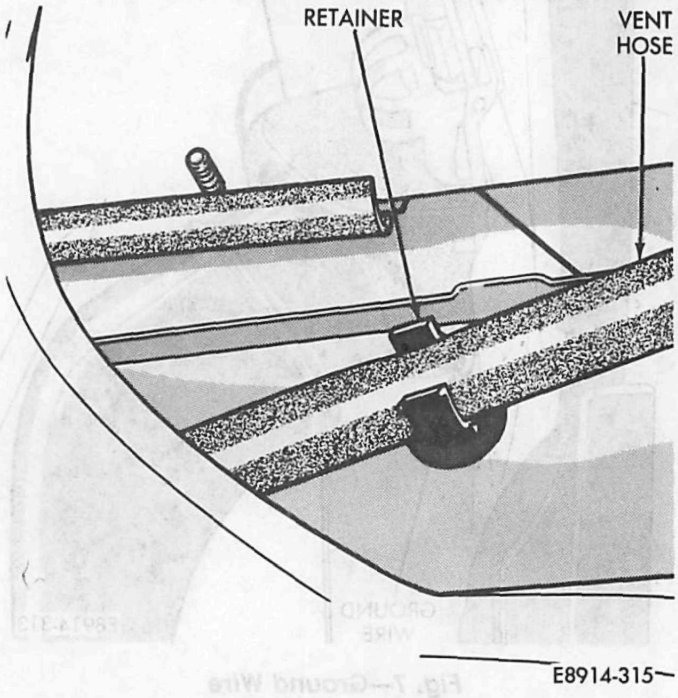


Fig. 9—Vent Hose Retainer Clip

(9) Slide fuel tank vent hose out of retainer clip on the frame (Fig. 9).

(10) Loosen and remove both nuts securing fuel tank support strap (Fig. 10). Push the other end of the strap up and out the left side frame rail.

(11) Place a transmission jack under the fuel tank to support it while removing the tank.

The black colored tube is the fuel supply tube and the gray colored tube is the return tube.

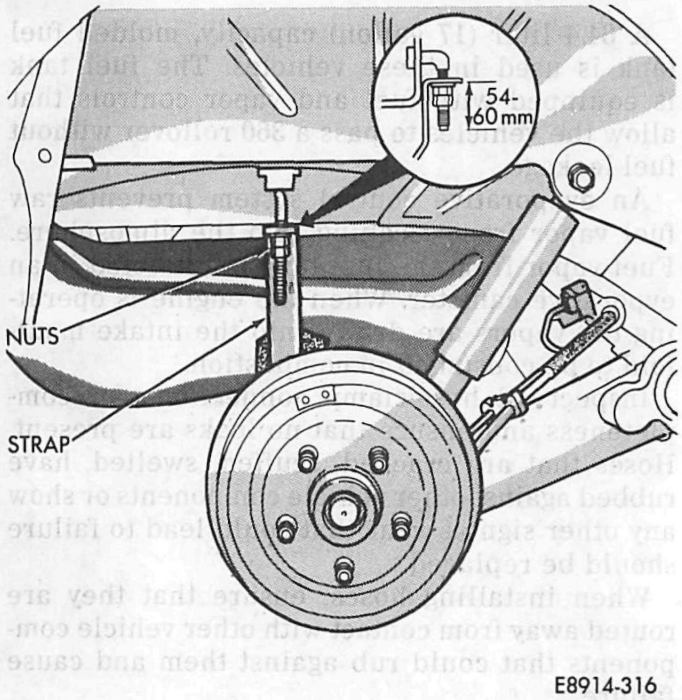


Fig. 10—Fuel Tank Strap

WARNING: THE FUEL SUPPLY SYSTEM MAY BE PRESSURIZED. WRAP SHOP TOWELS AROUND THE FUEL SUPPLY TUBE AND FUEL FILTER TO ABSORB FUEL SPRAY WHEN DISCONNECTING THE QUICK-CONNECT FITTING. WEAR EYE PROTECTION AND EXTINGUISH ALL SMOKING DEVICES WHEN SERVICING THE FUEL TANK.

(12) Using a clean lint free cloth, wipe the quick-connect fitting connections at fuel filter inlet nipple and in the grey fuel return tube clean of dirt and/or road salt. Spray compressed air around the retainer area of the fittings to remove any loosened dirt or road salt. Disconnect the quick-connect fittings by squeezing the retainer tabs and pulling the fitting back (Fig. 11). **The quick-connect retainer will stay on the nipple.**

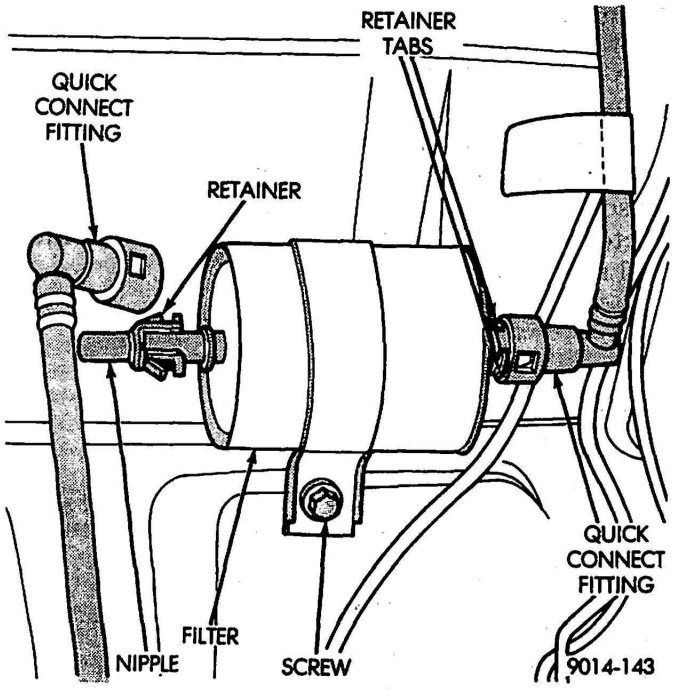


Fig. 11—Fuel Supply Tube and Fuel Filter Quick-Connect Fitting

(13) Pull fuel tank to fuel filter supply tube through the access hole in frame towards fuel tank.

(14) Disconnect fuel pump/sending unit electrical connector. The connector is slid onto a mounting bar attached to the frame.

(15) Disconnect the fuel tube from the fuel tank rollover/pressure release valves to the fuel tank to evaporator canister vapor tube at the connecting hose.

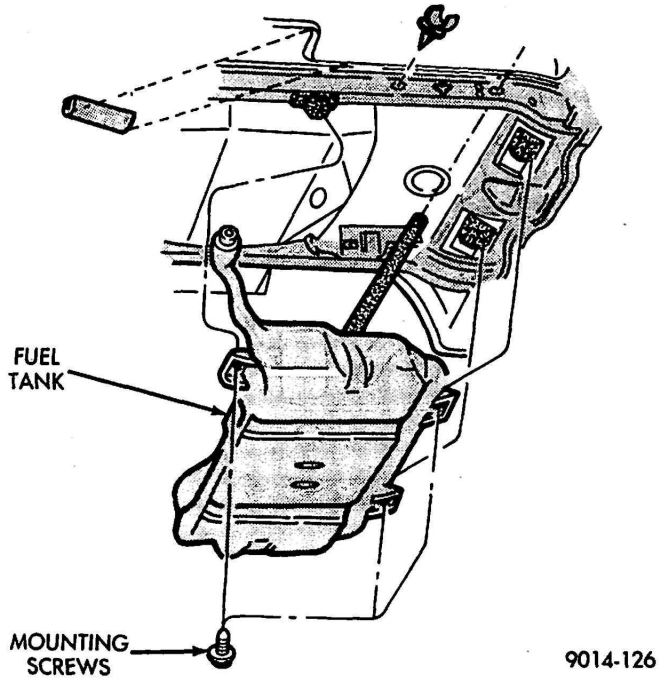


Fig. 12—Fuel Tank Removal/Installation

(16) Remove fuel tank mounting bolts (Fig. 12). The fuel tank is now supported by the transmission jack only.

(17) Lower the fuel tank on the transmission jack 2 to 3 inches.

(18) Push fuel tank vent hose towards the fuel tank through access hole in frame (Fig. 13).

CAUTION: When lowering the fuel tank on the transmission jack, it is necessary to tip the rear of the tank down to allow the two mounting flanges to slide out from above the rear axle. Support the tank so that it does not fall from the transmission jack.

(19) Lower the tank and remove it from the transmission jack.

Installation

(1) Center fuel tank on transmission jack.

(2) Raise jack until the fuel tank is 8 to 10 inches below vehicle.

(3) Tip front of fuel tank up over rear axle and continue raising tank until it is 1 to 2 inches away from being in place.

(4) Route the fuel tank filler vent hose through access hole in the frame (Fig. 13).

(5) Continue raising tank into place.

(6) Install fuel tank mounting bolts. Tighten the bolts to 16 N·m (12 ft-lbs) torque.

(7) Remove transmission jack.

(8) Install fuel tank support strap. Tighten top nut until distance between the bottom of the strap bolt and the strap is 54-60 mm (2.125-2.362 in.). Refer to Figure 10.

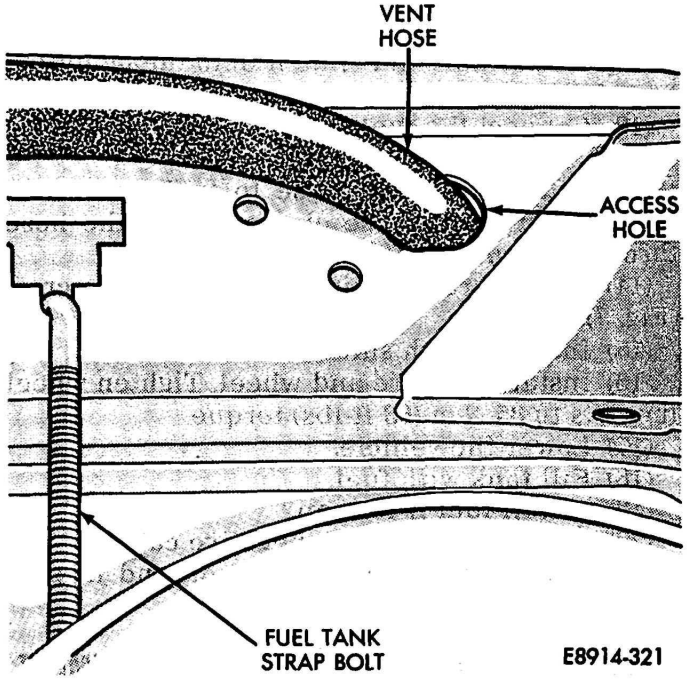


Fig. 13—Vent Hose Removal/Installation

(9) Push black fuel support hose through hole in body.

The O-Rings in the fuel tube quick-connect fittings are sealed in place and do not have to be replaced each time the quick-connect fittings are disconnect.

The fuel tube nipples must be lubricated with clean 30 weight engine oil prior to reconnecting the quick-connect fitting.

When the fuel supply tube to fuel filter quick-connect fitting, and the fitting in the gray fuel return tube were disassembled, the quick-connect fitting retainers remained on the nipples of the filter and fuel tube.

CAUTION: The retainer is required as a part of the quick-connect fitting to lock the tube into the fitting. A fuel tube should never be inserted into a quick-connect fitting without the retainer being either on the tube or already in the quick-connect fitting. In either case, care must be taken to ensure that the retainer is locked securely into the quick-connect fitting.

If the quick-connect fitting is the type that has "windows" in the sides, the retainer locking "ears" and the shoulder (stop bead) on the fuel tube must be completely visible in the windows. After connecting a quick-connect fitting, the connection should always be verified by pulling on the lines to ensure that the lock is secure. Refer to Fuel Tubes and Quick-Connect Fittings in this Group.

(10) Connect the quick-connect fittings at the fuel filter (Fig. 11) and the in-line fitting in the gray fuel return tube.

(11) Connect electrical connector for the fuel pump/sender unit and slide it onto the mounting bar attached to the frame.

(12) Connect the fuel tank to evaporator canister tube.

(13) Attach fuel vent hose to fuel tank filler neck. Secure with hose clamp. Route the hose through the clip on the body (Fig. 9).

(14) Install ground wire with retaining screw (Fig. 7).

(15) Install splash shield in wheel well.

(16) Install rear tire and wheel. Tighten wheel lug nuts to 85 N·m (63 ft-lbs) torque.

(17) Lower the vehicle.

(18) Fill tank with fuel.

(19) Install fuel filler cap.

(20) Connect the battery negative cable.

(21) Turn key to the ON position and inspect for leaks.

FUEL PUMP/GAUGE SENDER UNIT REPLACEMENT

The Fuel Pump/Sender Unit is located in the fuel tank.

Removal

(1) Disconnect the battery negative cable.

(2) Remove fuel tank. Refer to Fuel Tank Removal.

(3) Disconnect the quick-connect fittings of the black fuel supply tube and grey fuel return tube by squeezing retainer tabs and then pulling connectors away from nipples (Fig. 14). Retainers will stay on the nipples (Fig. 15).

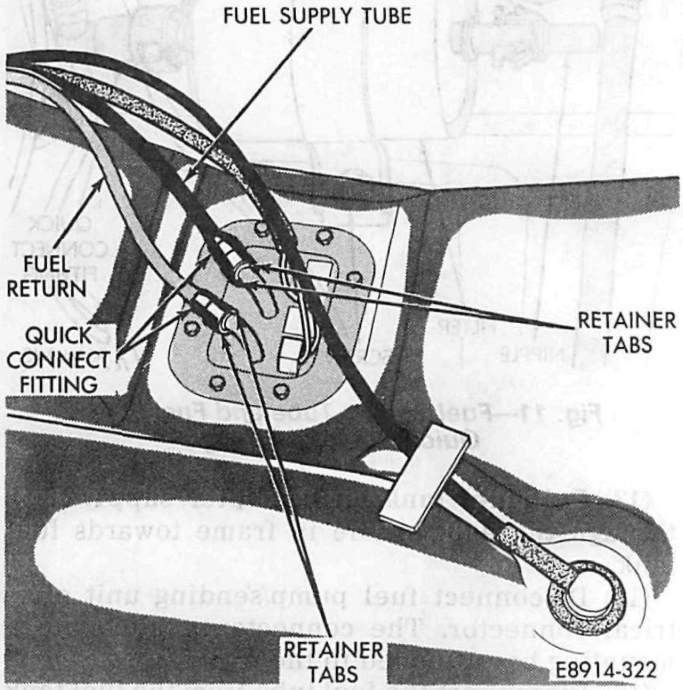


Fig. 14—Disconnecting Fuel Supply and Return Tubes

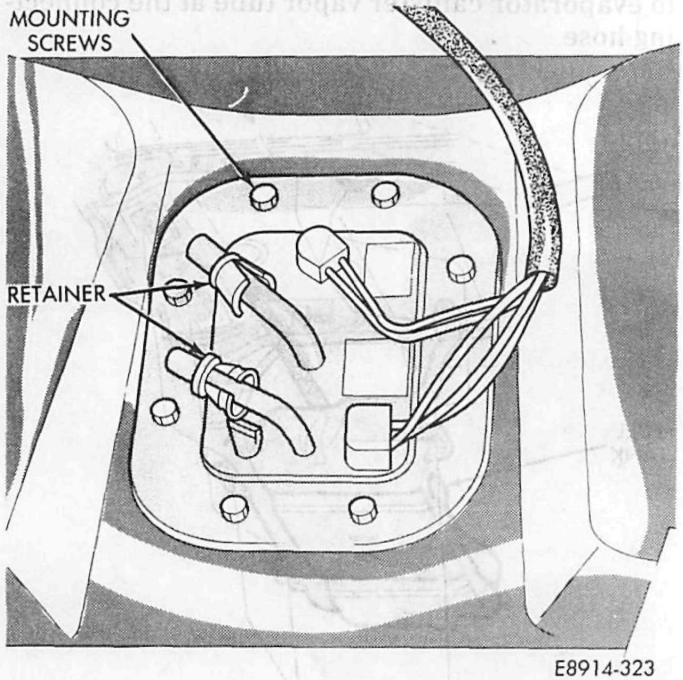


Fig. 15—Quick-Disconnect Fitting Retainers

(4) Remove bolts that hold fuel pump/sender unit face plate to the fuel tank (Fig. 15).

(5) Carefully pull fuel pump/sender unit out from the fuel tank. It will be necessary to tilt the unit forward and backwards to allow the fuel filter and float arm room for removal. Note the position of gasket for correct reassembly (Fig. 16).

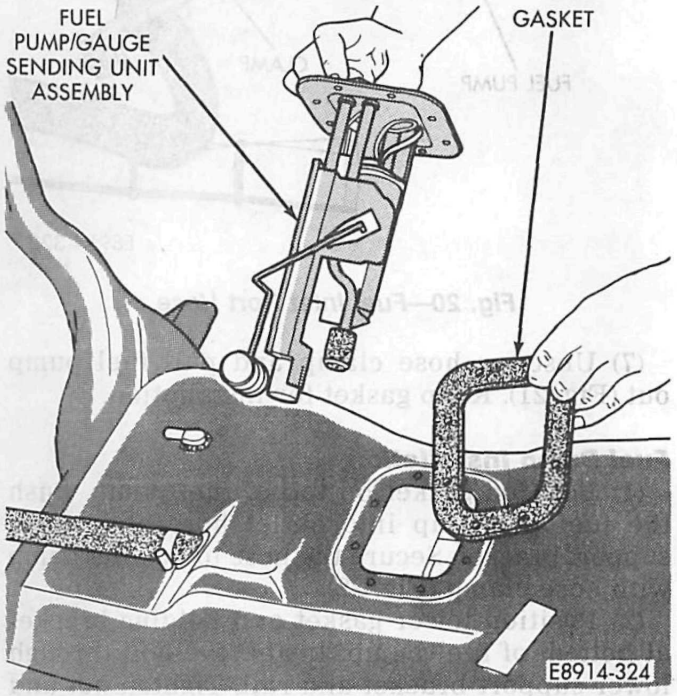


Fig. 16—Fuel Pump/Gauge Sending Unit Removal/ Installation

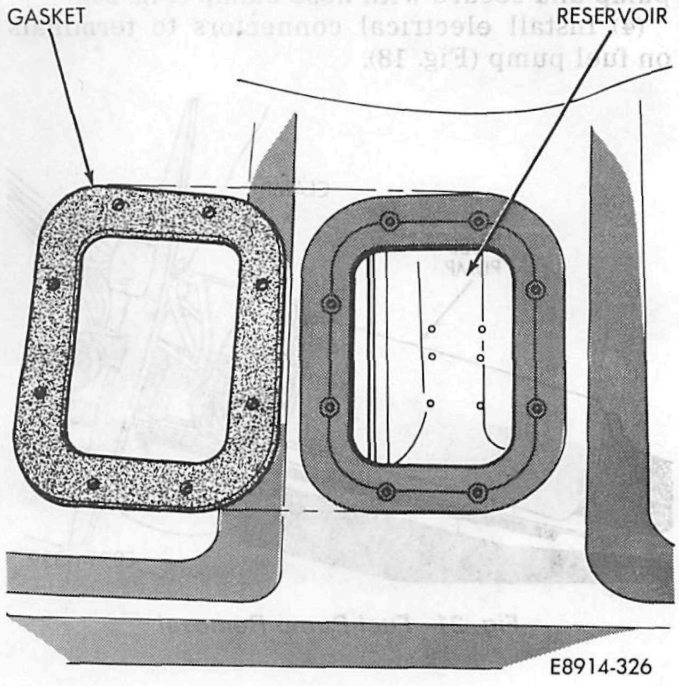


Fig. 17—Fuel Reservoir

Installation

There is a fuel reservoir (tray) in the bottom of the fuel tank that is contoured to hold the fuel filter (Fig. 17). Be sure to install the fuel pump/ sender unit so that the filter correctly fits into the tray.

(1) Position gasket so that the holes in the gasket line up with the bolt holes in the fuel tank.

(2) Lower the fuel pump/sender unit into the fuel tank. It will be necessary to tilt the assembly backwards and forwards to provide clearance for the fuel filter and float arm.

(3) Screw the retaining bolts into the tank.

The O-Rings in the fuel tube quick connectors are sealed in place. They do not have to be replaced each time the Quick-Connect fittings are disconnected.

The fuel tube nipples on the faceplate of the fuel pump/gage sending unit must be lubricated with clean 30 weight engine oil before reconnecting the quick-connect fittings.

When the fuel supply and return tubes were disconnected, the retainers remained on the nipples of the fuel pump/gauge sending unit faceplate.

CAUTION: The retainer is required as a part of the quick-connect fitting to lock the tube into the fitting. A fuel tube should never be inserted into a quick-connect fitting without the retainer being either on the tube or already in the quick-connect fitting. In either case, care must be taken to ensure that the retainer is locked securely into the quick-connect fitting.

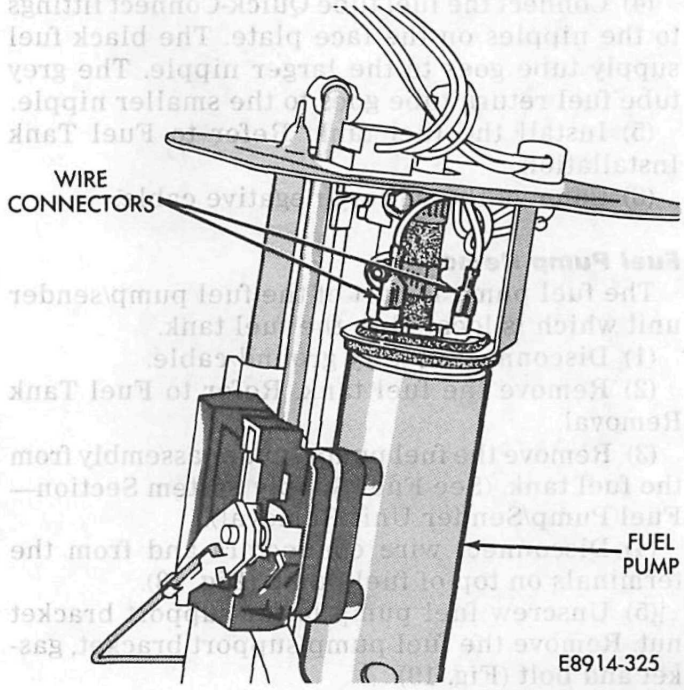


Fig. 18—Fuel Pump Wire Connectors

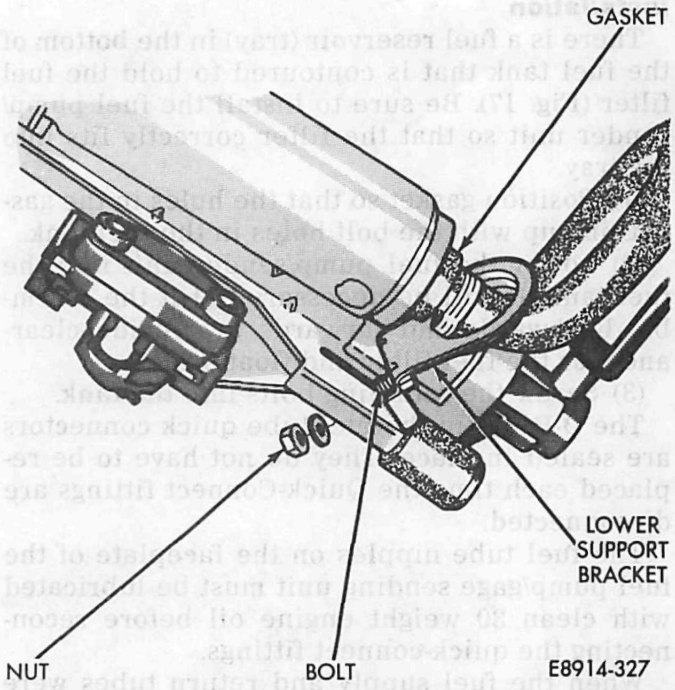


Fig. 19—Fuel Pump Lower Support Bracket

If the quick-connect fitting has "windows" in the sides, the retainer locking "ears" and the shoulder (stop bead) on the fuel tube must be completely visible in the windows. After connecting a quick-connect fitting, the connection should always be verified by pulling on the lines to ensure that the lock is secure. Refer to Fuel Tubes and Quick-Connect Fittings in this group.

(4) Connect the fuel tube Quick-Connect fittings to the nipples on the face plate. The black fuel supply tube goes to the larger nipple. The grey tube fuel return tube goes to the smaller nipple.

(5) Install the fuel tank. Refer to Fuel Tank Installation.

(6) Connect the battery negative cable.

Fuel Pump Removal

The fuel pump is part of the fuel pump/sender unit which is located in the fuel tank.

(1) Disconnect battery ground cable.

(2) Remove the fuel tank. Refer to Fuel Tank Removal.

(3) Remove the fuel pump/sender assembly from the fuel tank. (See Fuel Supply System Section—Fuel Pump/Sender Unit Removal).

(4) Disconnect wire connectors and from the terminals on top of fuel pump (Fig. 18).

(5) Unscrew fuel pump lower support bracket nut. Remove the fuel pump support bracket, gasket and bolt (Fig. 19).

(6) Disconnect hose clamp at inlet port of fuel pump (Fig. 20).

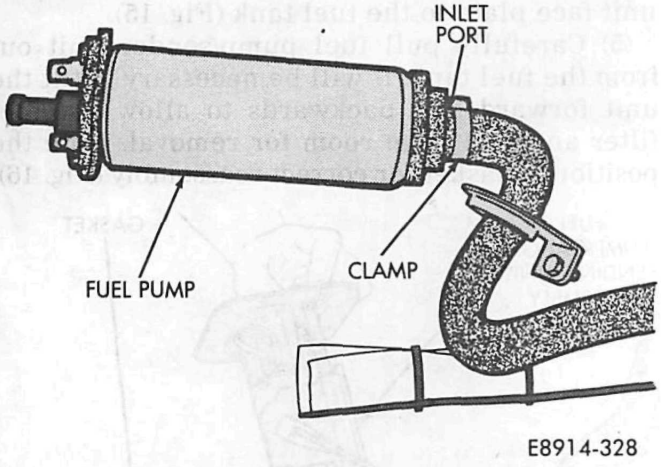


Fig. 20—Fuel Inlet Port Hose

(7) Unscrew hose clamp and pull fuel pump out (Fig. 21). Keep gasket for installation.

Fuel Pump Installation

(1) Position gasket on top of fuel pump. Push the fuel pump up into outlet hose and upper support bracket. Secure the hose to the fuel pump with hose clamp (Fig. 22).

(2) Position lower gasket and holding bracket at bottom of fuel pump. Install the bolt through lower support bracket and rail. Tighten nut and bolt securely (Fig. 19).

(3) Connect the hose to inlet port of the fuel pump and secure with hose clamp (Fig. 20).

(4) Install electrical connectors to terminals on fuel pump (Fig. 18).

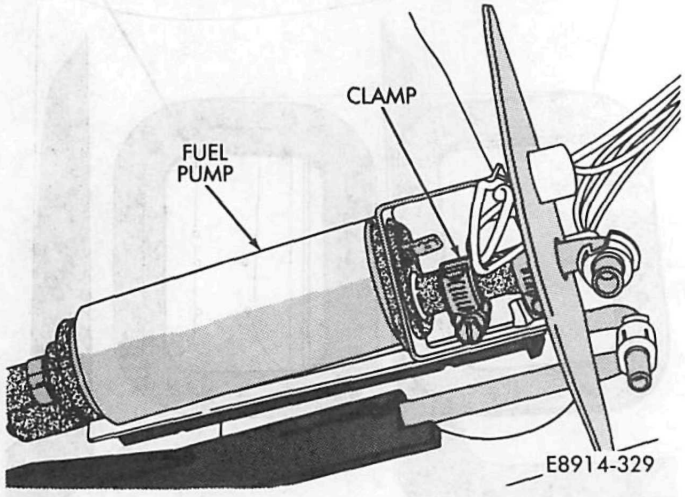


Fig. 21—Fuel Pump Removal

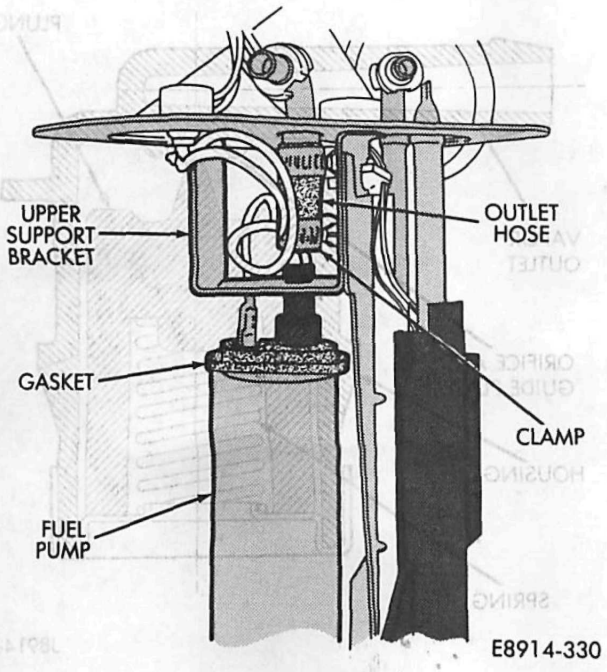


Fig. 22—Fuel Pump Installation

(5) Install fuel pump/sender unit into fuel tank. Refer to Fuel Pump/Gauge Sending Unit Installation.

(6) Install the fuel tank. Refer to Fuel Tank Installation.

(7) Connect battery negative cable to battery.

In-Tank Fuel Filter Removal

(1) Remove the fuel tank. Refer to Fuel Tank Removal.

(2) Remove the fuel pump/sender unit from the fuel tank. Refer to Fuel Pump/Gauge Sending Unit Removal.

(3) Remove fuel filter from the fuel pump/gauge sending unit by pulling the filter down (Fig. 23).

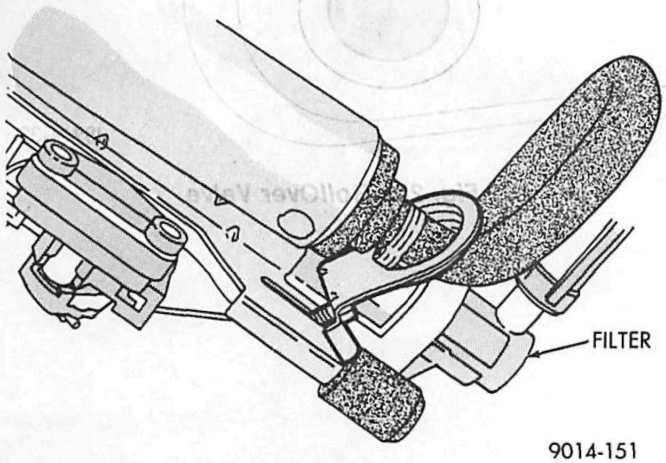


Fig. 23—In-Tank Fuel Filter Removal/Installation

In-Tank Fuel Filter Installation

(1) Push fuel filter onto bottom of unit.

(2) Install fuel pump/sender unit into fuel tank. Refer to Fuel Pump/Sender Unit Installation.

(3) Install fuel tank. Refer to Fuel Tank Installation.

FUEL RESERVOIR

The fuel tanks are equipped with a fuel reservoir (Fig. 24) that provides fuel to the fuel pump inlet during all driving conditions, especially when the fuel tank has a low level of fuel. The reservoir is a small tray with raised sides that the fuel pump inlet sits in. The fuel return tube empties into a small cup in the reservoir that is ported to the rest of the tank. The combination of return fuel and fuel from the main tank keeps the reservoir full even when the fuel level in the main tank is below the level in the reservoir.

FUEL TANK ROLLOVER VALVE

The fuel tanks are equipped with two rollover valves. The dual function valves relieve fuel tank pressure and prevent fuel flow through the fuel tank vent hoses in the event of vehicle rollover.

The valve consists of a plunger, spring, and an orifice and guide plate (Fig. 25). The valve is normally open. In the closed position, force applied by spring pressure seats the plunger against the guide plate, shutting off the flow of fuel vapor from the fuel tank to the evaporative canis-

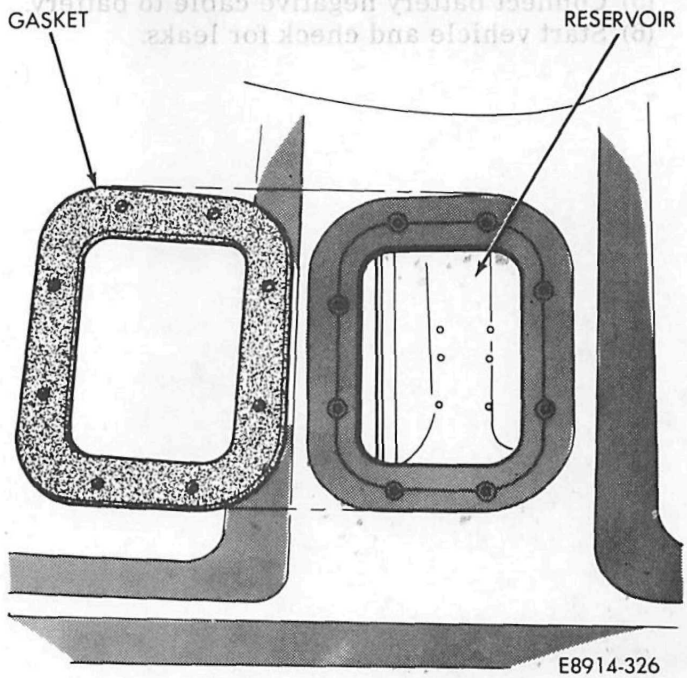


Fig. 24—Fuel Tank Reservoir

ter. When fuel does not reach the valve, the spring pressure is overcome and the plunger moves away from the guide plate allowing fuel vapor to flow through the valve orifice.

In vehicle rollover the valve is inverted. In this position the plunger is forced against the guide plate and raw fuel is prevented from flowing through the valve orifice into the fuel tank vent tube.

Removal

(1) Disconnect battery negative cable from the battery.

(2) Remove the fuel filler cap and drain fuel tank. Refer to Draining Fuel Tank.

(3) Remove fuel tank. Refer to Fuel Tank Removal.

(4) The rollover valve is seated in a grommet. Remove by prying one side upward and then roll the grommet out of tank (Fig. 26). **Do not pry on the nipple of the rollover valve.**

Installation

(1) Start one side of grommet into opening in fuel tank and using finger pressure only, roll the grommet into place.

(2) Use finger pressure only, roll the rollover valve into the grommet. It may be necessary to lightly lubricate the valve with silicon spray or power steering fluid to ease valve installation.

(3) Install fuel tank. Refer to Fuel Tank Installation.

(4) Fill fuel tank. Install fuel tank filler cap.

(5) Connect battery negative cable to battery.

(6) Start vehicle and check for leaks.

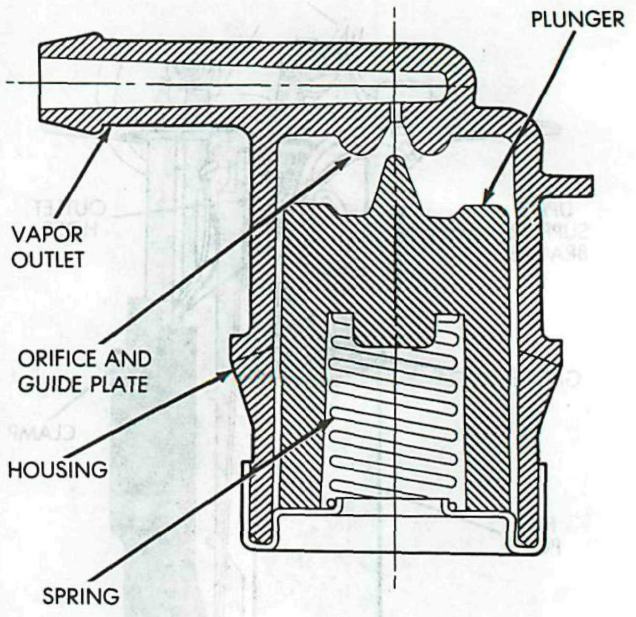


Fig. 25—RollOver Valve Operation

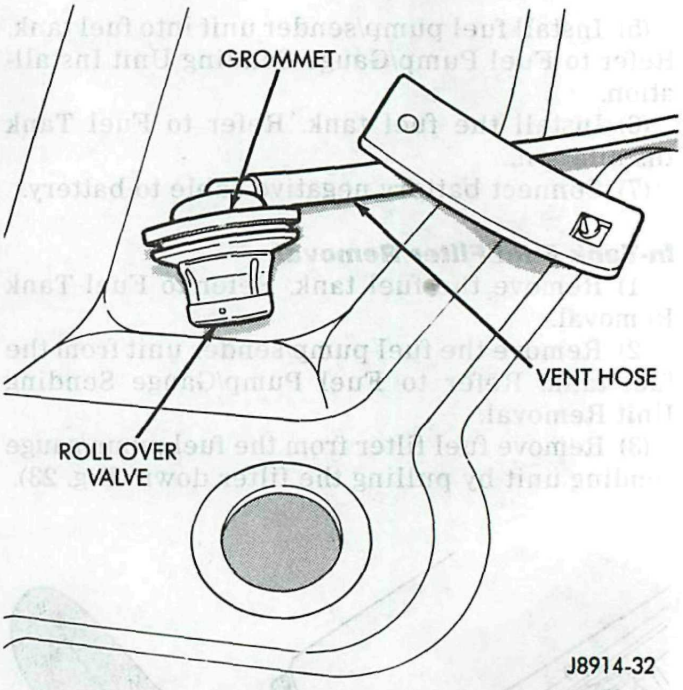


Fig. 26—RollOver Valve

ACCELERATOR PEDAL AND CABLE

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GENERAL INFORMATION

The accelerator pedal is connected to the throttle lever by the accelerator cable. The cable is protected by an outer sheathing. The cable is connected to the throttle lever by a clasp and to the accelerator pedal by a clip that snaps into the top of the pedal arm.

SERVICE PROCEDURES

Accelerator Pedal

Removal

(1) The clip connecting the accelerator cable and pedal has tabs on the backside. Compress the tabs and pull clip forward. Gently slide accelerator cable out of opening in top of pedal arm taking care not to damage or kink throttle core wire.

(2) Remove accelerator pedal mounting nuts. Remove accelerator pedal (Fig. 1).

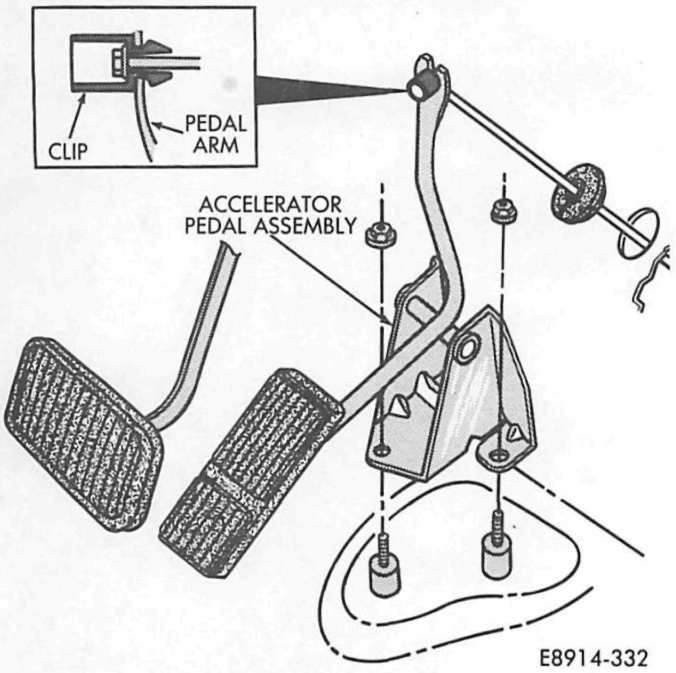


Fig. 1—Accelerator Pedal Removal/Installation

Installation

(1) Place accelerator pedal over studs protruding from floorpan (Fig. 1). Tighten mounting nuts to 4.3 N·m (36 in-lbs) torque.

(2) Slide accelerator cable into opening in top of pedal arm. Push cable clip into pedal arm opening until it snaps in place (Fig. 1).

Accelerator Cable

Removal

(1) The clip connecting the accelerator cable and pedal has tabs on the backside. Compress the tabs and pull clip forward. Gently slide accelerator cable out of opening in top of pedal arm taking care not to damage or kink cable core wire (Fig. 1).

(2) The accelerator cable is anchored to dash panel by retainer tabs built into the cable sheathing. The tabs are located behind the accelerator pedal arm. From inside the drivers compartment, compress the retainer tabs and push cable through dash panel.

(3) At the throttle body, use a straight blade screwdriver to disconnect the accelerator cable clasp from throttle lever (Fig. 2).

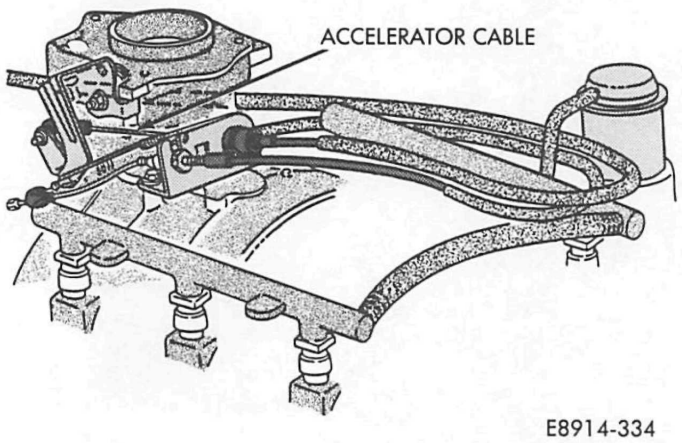


Fig. 2—Accelerator Cable Removal/Installation—3.0L Engine

(4) Remove accelerator cable from throttle bracket by compressing retainer tabs and gently pushing cable through hole in bracket (Fig. 2). Remove accelerator cable.

Installation

(1) Slide clasp end of accelerator cable through hole in throttle bracket until retainer tabs lock into bracket (Fig. 2).

(2) Connect cable clasp to ball stud on throttle lever (Fig. 2).

(3) Push other end of cable through opening in dash panel until retaining tabs lock onto panel (Fig. 2).

(4) From inside drivers compartment, slide accelerator cable into opening on top of pedal arm. Push cable clip into pedal arm opening until it snaps into place (Fig. 1).

MULTI-POINT FUEL INJECTION (MPI) 3.0L ENGINE

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COMPONENT IDENTIFICATION

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GENERAL INFORMATION

The 3.0L engines' Multi-Point Fuel Injection system is a simultaneous double fire type. All injectors fire simultaneously once every engine revolution, delivering half of the fuel needed for combustion. Since two engine revolutions are required to complete one engine cycle, the injectors fire twice every cycle. Hence the term "simultaneous double fire."

The injectors fire into the intake manifold directly above each intake valve port. There is one injector per engine cylinder. Each injector protrudes through the intake manfold into the top of the corresponding intake valve port. The injectors are controlled exclusively by the engines' Electronic Control Unit (ECU).

The ECU constantly adjusts the amount of fuel injected to meet changing operating conditions by controlling injector pulse width (the length of time the injector is energized). The ECU also adjusts ignition timing by controlling the ignition coil operation through the ignition control module. The ECU determines air-fuel mixture and ignition timing based on inputs it receives from various sensors that monitor engine operating conditions.

The ECU receives inputs from sensors that react to exhaust gas oxygen content, coolant temperature, manifold absolute pressure, engine speed (crankshaft position), throttle position, battery voltage, intake manifold, air temperature, and transmission gear selection. These inputs represent the engines' instantaneous operating conditions. Air-Fuel mixture and ignition timing calibrations for various driving and atmospheric conditions are pre-programmed into the ECU. The ECU monitors and analyzes its various inputs, computes engine fuel and ignition timing requirements based on these inputs, and controls fuel delivery and ignition timing accordingly. The ECU, the various sensors and switches that provide input to the ECU, and the ECU outputs (engine control devices controlled by the ECU) comprise the engine control system.

The engine control system consists of:

- Battery voltage
- Manifold absolute pressure (MAP) sensor
- Coolant temperature sensor
- Manifold air temperature (MAT) sensor
- Exhaust Oxygen (O_2) sensor
- Speed (crankshaft position) sensor
- Throttle position sensor
- Injector power signal
- Air conditioning select signal
- Air conditioning request signal
- Neutral safety switch (gear selection—auto, trans.)
- Ignition ON signal
- Engine crank signal
- Vehicle speed sensor
- Fuel pump relay

- Fuel injectors
- Idle speed regulator
- B+ latch relay
- Air Conditioning Control Module
- EGR valve solenoid
- Ignition control module

System Diagnosis

For diagnosing MPI electronic control system malfunctions refer to the DRB II Service Diagnostic Tester and accompanying manual. The DRB II tester plugs into two diagnostic connectors inside the engine compartment. After performing the required diagnostic test the tester will display a fault code if a malfunction is detected. Diagnostic charts for all fault codes are listed in the tester manual. Individual component diagnosis is included in this section.

ELECTRONIC CONTROL UNIT (ECU)

The Eletronic Control Unit (ECU) is a digital microprocessor. Air-Fuel mixture calibrations for various driving and atmospheric conditions are preprogrammed into the ECU. The ECU monitors and analyzes its various inputs, computes engine fuel and ignition timing requirements based on these inputs, and controls fuel delivery and ignition timing accordingly. As operating conditions change, the ECU adjusts injector pulse width and ignition timing for optimum performance and fuel economy.

ECU Inputs

The ECU is powered by the vehicle's battery. When the ignition is turned to the ON or START position, the following inputs are supplied to the ECU:

- Battery voltage
- Manifold absolute pressure (MAP) sensor
- Coolant temperature sensor
- Manifold air temperature (MAT) sensor
- Exhaust Oxygen (O_2) sensor
- Speed (crankshaft position) sensor
- Throttle position sensor
- Injector power signal
- Air conditioning select signal
- Air conditioning request signal
- Neutral safety switch (gear selection—auto, trans.)
- Ignition relay—ON signal
- Starter relay—engine crank signal
- Vehicle speed sensor

ECU Outputs

Based upon input signals from the various input sensors and switches, the ECU adjusts the following components (ECU outputs):

- Fuel pump relay
- B+ latch relay
- Air Conditioning Control Module
- Fuel injectors
- Idle speed regulator
- EGR valve solenoid
- Ignition control module

BATTERY VOLTAGE—ECU INPUT

The battery voltage input to the ECU is used to ensure that proper voltage is applied to the fuel injector. The ECU varies the injector pulse width to compensate for battery voltage fluctuations and their effects on injector opening time.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—ECU INPUT

The MAP sensor reacts to absolute pressure in the intake manifold and provides an input voltage to the ECU. As engine load changes manifold pressure varies, causing the MAP sensors resistance to change. The change in MAP sensor resistance results in a different input voltage to the ECU. The input voltage level supplies the ECU with information relating to ambient barometric pressure during engine start-up (cranking) and to engine load while the engine is running. The ECU uses this information to adjust the air-fuel mixture accordingly.

The MAP sensor is mounted in the engine compartment on the dash panel and is connected to the throttle body with a vacuum hose (Fig. 1).

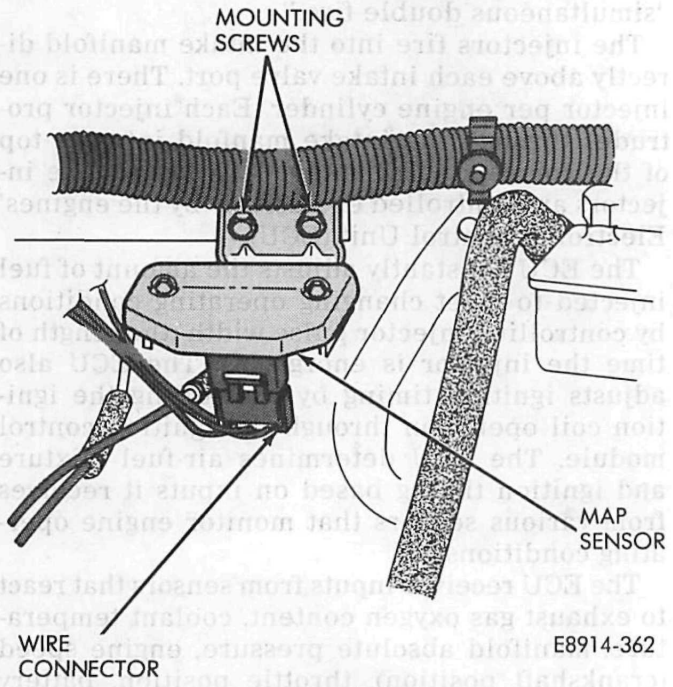


Fig. 1—MAP Sensor

COOLANT TEMPERATURE SENSOR—ECU INPUT

The coolant temperature sensor is installed in the thermostat housing (Fig. 2). It provides an input voltage to the ECU. As coolant temperature varies, the Coolant Temperature Sensor resistance changes resulting in a different input voltage to the ECU. Based on this input the ECU will:

- Adjust fuel injector pulse with. Colder coolant temperatures will result in longer injector pulse width and richer air-fuel mixtures.
- Compensate for fuel condensation in the intake manifold.
- Control engine warm-up idle speed.
- Increase ignition advance when the coolant is cold.
- Energize the EGR valve solenoid thus preventing the flow of vacuum to the EGR valve.

MANIFOLD AIR TEMPERATURE (MAT) SENSOR—ECU INPUT

The Manifold Air Temperature (MAT) sensor is installed in the throttle body adapter at the rear of the intake manifold with sensor element extending into the air stream (Fig. 3) The MAT sensor provides an input voltage to the ECU. As the temperature of the air stream in the manifold varies, the MAT sensor resistance changes resulting in a different input voltage to the ECU.

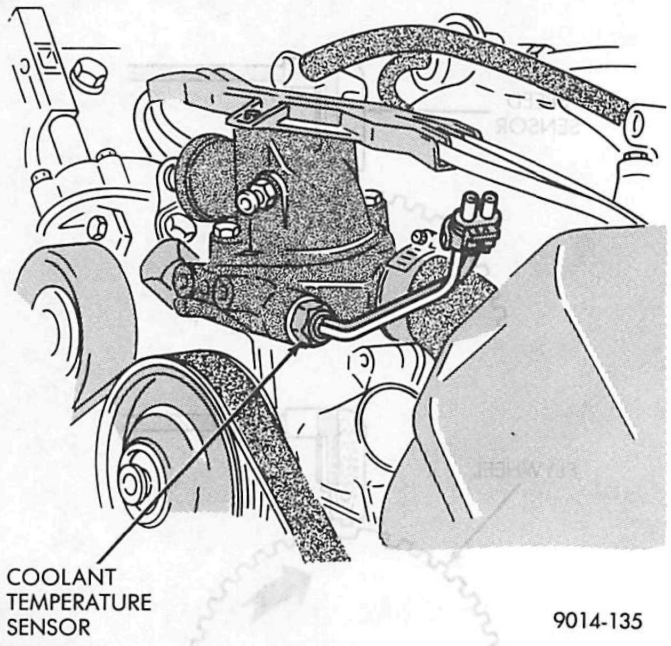


Fig. 2—Coolant Temperature Sensor

EXHAUST GAS OXYGEN SENSOR (O_2 SENSOR)—ECU INPUT

The oxygen sensor is located in the exhaust "Y" pipe and provides an input voltage to the ECU relating the oxygen content of the exhaust gas (Fig. 4). The ECU uses this information to vary the air-fuel ratio.

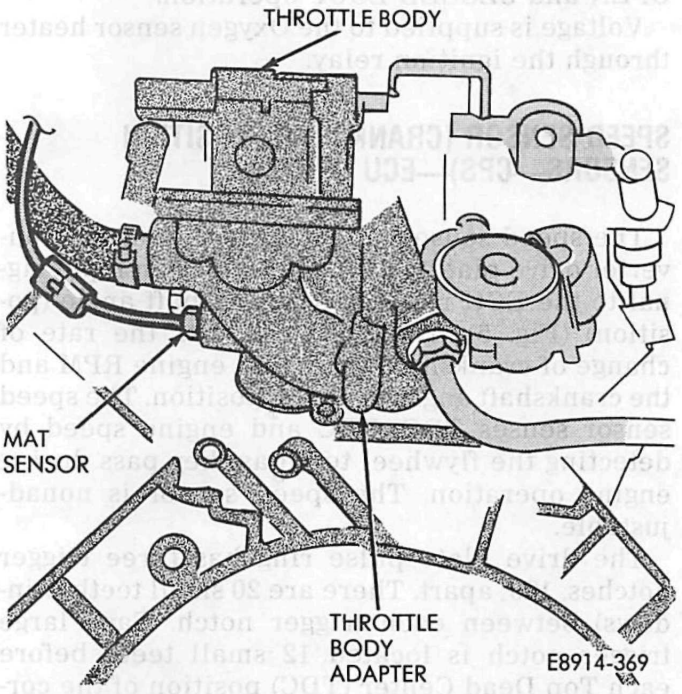


Fig. 3—Manifold Air Temperature Sensor

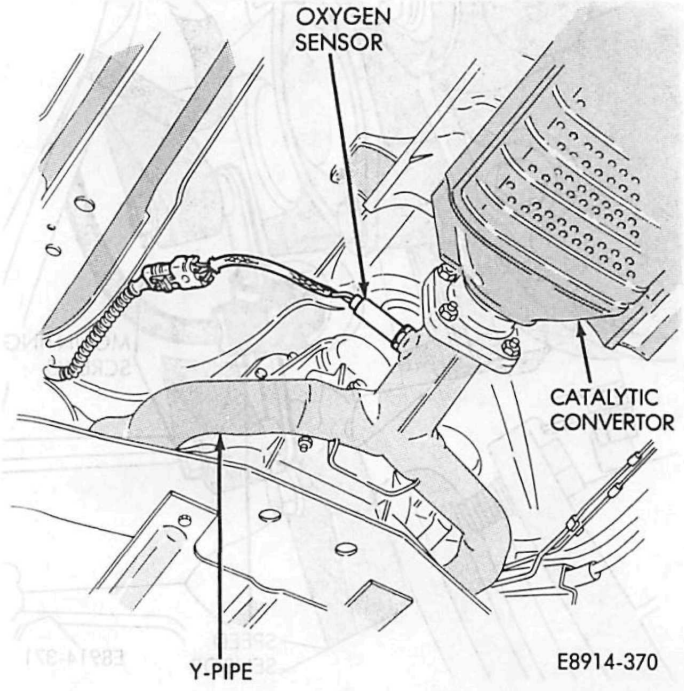


Fig. 4—Heated Oxygen Sensor

The oxygen sensor is equipped with a heating element that keeps the sensor at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner and to remain in closed loop operation during periods of extended idle. Refer to Modes of Operation for an explanation of OPEN and CLOSED LOOP operation.

Voltage is supplied to the Oxygen sensor heater through the ignition relay.

SPEED SENSOR (CRANKSHAFT POSITION SENSORS—CPS)—ECU INPUT

The speed sensor, attached to the torque converter drive plate housing, provides an input signal to the ECU relating to crankshaft angle (position) (Fig. 5). The ECU converts the rate of change of crankshaft angle into engine RPM and the crankshaft angle to piston position. The speed sensor senses TDC, BDC and engine speed by detecting the flywheel teeth as they pass during engine operation. The speed sensor is nonadjustable.

The drive plate pulse ring has three trigger notches, 120° apart. There are 20 small teeth (windows) between each trigger notch. Each large trigger notch is located 12 small teeth before each Top Dead Center (TDC) position of the corresponding pistons (Fig. 6).

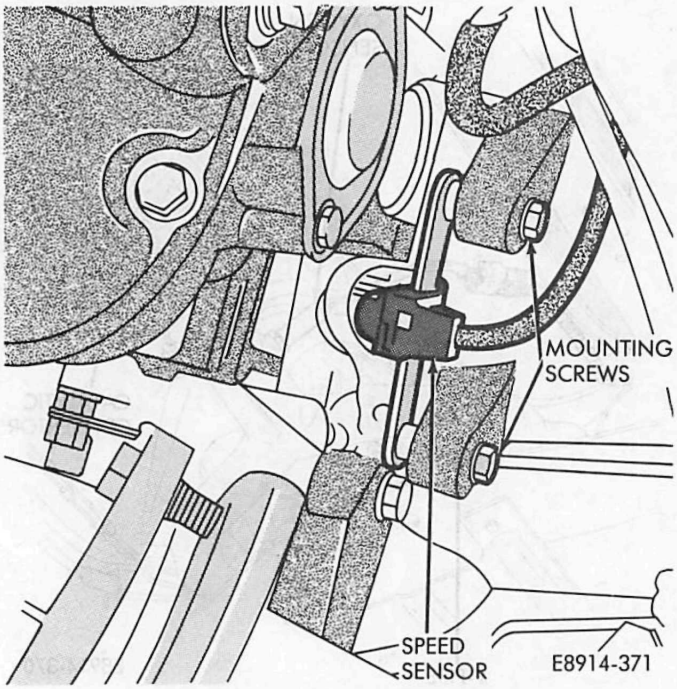


Fig. 5—Engine Speed Sensor

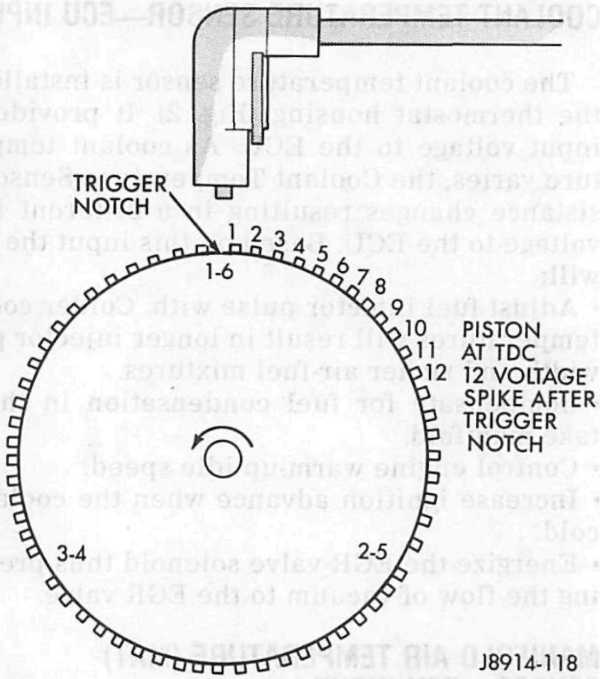


Fig. 6—Engine Speed Sensor, Trigger Notches and TDC Position

When a tooth and notch pass the magnet core of the speed sensor, a voltage spike is induced in the sensor pick-up coil winding (Fig. 7). The voltage spikes allow the ECU to count the teeth as they pass the sensor. When a trigger notch passes the speed sensor there is a longer than usual delay between voltage spikes. This longer delay tells the ECU that a piston will be at the TDC

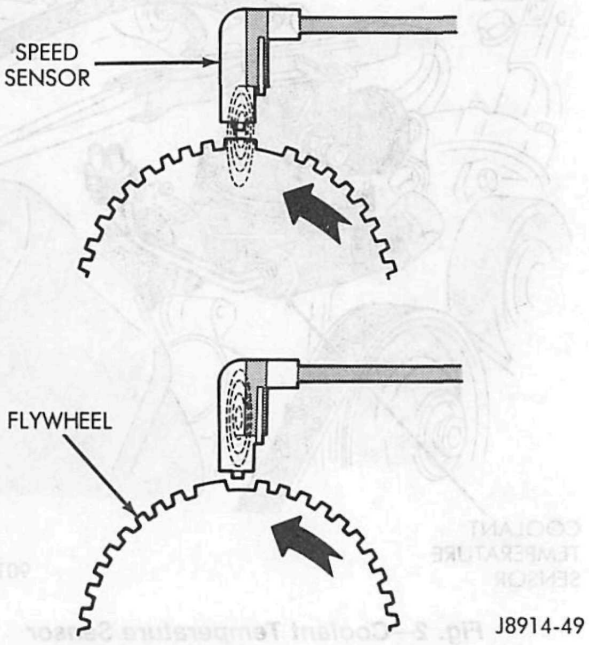


Fig. 7—Engine Speed Sensor Operation

position 12 voltage spikes later. The ECU uses information from the speed sensor to control spark timing and fuel injection timing for each cylinder.

The longer voltage spike indicates to the ECU that a piston will soon be at the TDC position, 12 teeth later. The ignition timing for the particular cylinder is either advanced or retarded as necessary by the ECU according to sensor inputs.

THROTTLE POSITION SENSOR (TPS)—ECU INPUT

The Throttle Position Sensor (TPS) is mounted on the throttle body and connected to the throttle valve shaft (Fig. 8). The sensor is a variable resistor that provides the ECU with an input voltage that represents throttle valve position. Input voltage to the ECU from the TPS varies in an approximate range or from 1 volt at minimum throttle opening (idle) to 4.5 volts at wide open throttle. The ECU uses TPS input voltage to determine current engine operating conditions.

NEUTRAL SAFETY SWITCH—ECU INPUT

On vehicles equipped with automatic transmissions, a gear selection indicator signal is sent to the ECU from the neutral safety switch. When the transmission is in a drive range the ECU will adjust engine idle speed to compensate for increased engine load. Refer to group 21 for Neutral Safety Switch service.

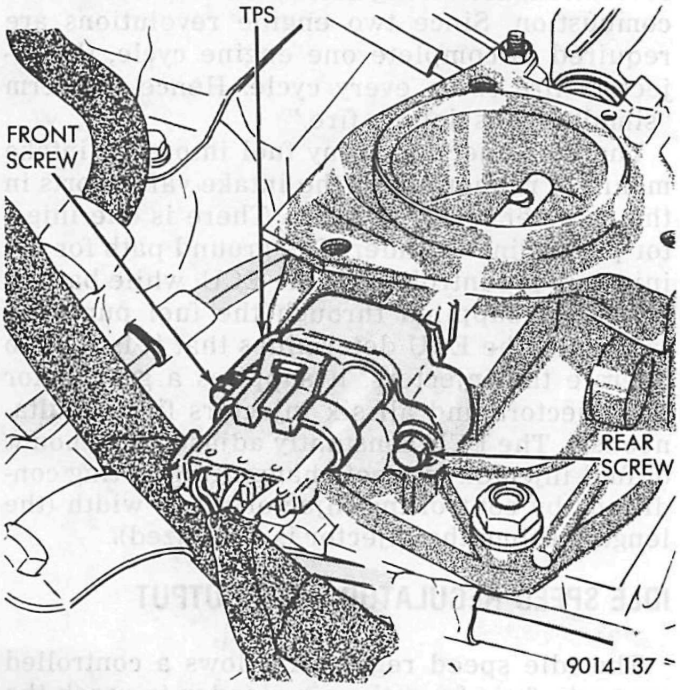


Fig. 8—Throttle Position Sensor

IGNITION "ON" RELAY

The ignition "ON" relay, which is mounted beneath a labeled cover with several other relays on the left strut tower (Fig. 10), provides I-1 power (from ignition switch) to the ECU when the ignition switch is turned to the "ON" position. After receiving this input, the ECU will energize the B+ latch relay and the idle speed regulator. The position of the ignition relay is imprinted on the top of the relay cover (Fig. 11).

STARTER RELAY (ENGINE CRANK SIGNAL)—ECU INPUT

The starter relay, which is mounted beneath a labeled cover with several other relays on the left strut tower (Fig. 10), provides a signal to the ECU informing it that the starter motor has been engaged. The ECU then begins monitoring engine sensors to determine correct engine timing. The position of the starter relay is imprinted on the top of the relay cover (Fig. 11).

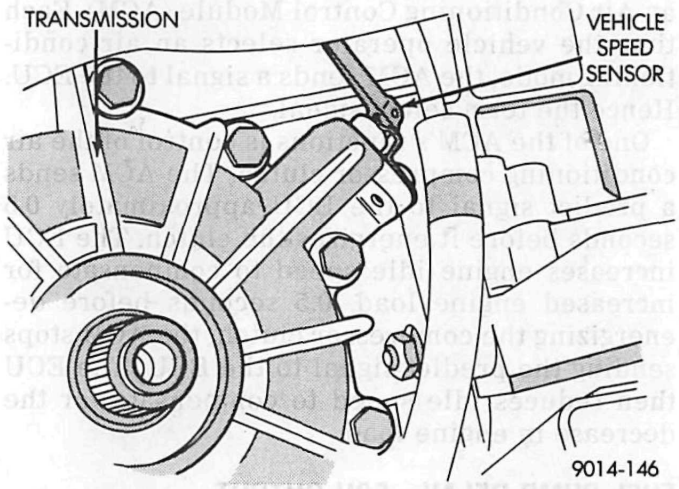


Fig. 9—Vehicle Speed Sensor

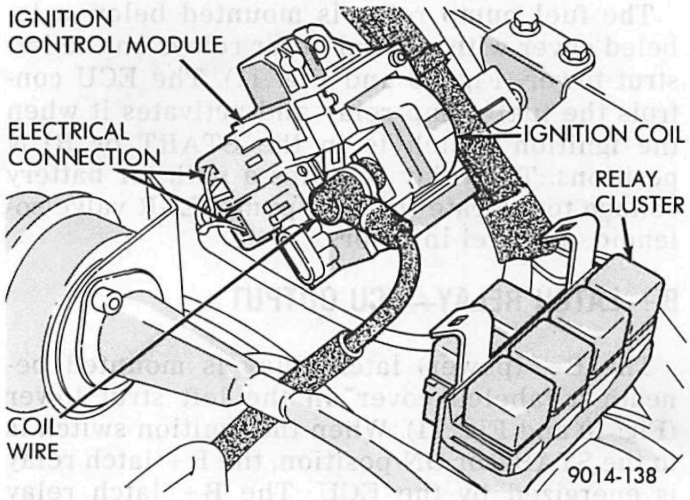


Fig. 10—Relay Cluster

INJECTOR POWER SIGNAL—ECU INPUT

The injector power input signal is a function of the fuel pump relay when the ignition switch is in the ON position. It informs the ECU about the amount of battery voltage supplied to the injectors. If battery power for the injectors is low, the ECU will increase injector pulse width to compensate for a slower injector opening time. The position of the fuel pump relay is imprinted on the top of the relay cover (Fig. 11).

VEHICLE SPEED SENSOR—ECU INPUT

The vehicle speed sensor is mounted on the right side of the transaxle and provides an input to the ECU pertaining to the vehicles speed. The ECU adjusts the fuel delivery rate in response to this and other inputs.

AIR CONDITIONING SELECT AND PREDICT SIGNALS—ECU INPUT

The air conditioning system is equipped with an Air Conditioning Control Module (ACM). Each time the vehicle operator selects an air conditioning mode, the ACM sends a signal to the ECU. Hence the term select signal.

One of the ACM's functions is control of the air conditioning compressor clutch. The ACM sends a predict signal to the ECU approximately 0.5 seconds before it energizes the clutch. The ECU increases engine idle speed to compensate for increased engine load. 0.5 seconds before de-energizing the compressor clutch, the ACM stops sending the predict signal to the ECU. The ECU then reduces idle speed to compensate for the decrease in engine load.

FUEL PUMP RELAY—ECU OUTPUT

The fuel pump relay is mounted below a labeled cover with several other relays on the left strut tower (Fig. 10 and Fig. 11). The ECU controls the fuel pump relay and activates it when the ignition switch is in the START or RUN positions. The relay supplies a path for battery voltage to operate the fuel pump, EGR valve solenoid, and fuel injectors.

B+ LATCH RELAY—ECU OUTPUT

The B+ (power) latch relay is mounted beneath a labeled cover on the left strut tower (Fig. 10 and Fig. 11). When the ignition switch is to the START or ON position, the B+ latch relay is energized by the ECU. The B+ latch relay provides voltage to the idle speed regulator in anticipation of engine start-up.

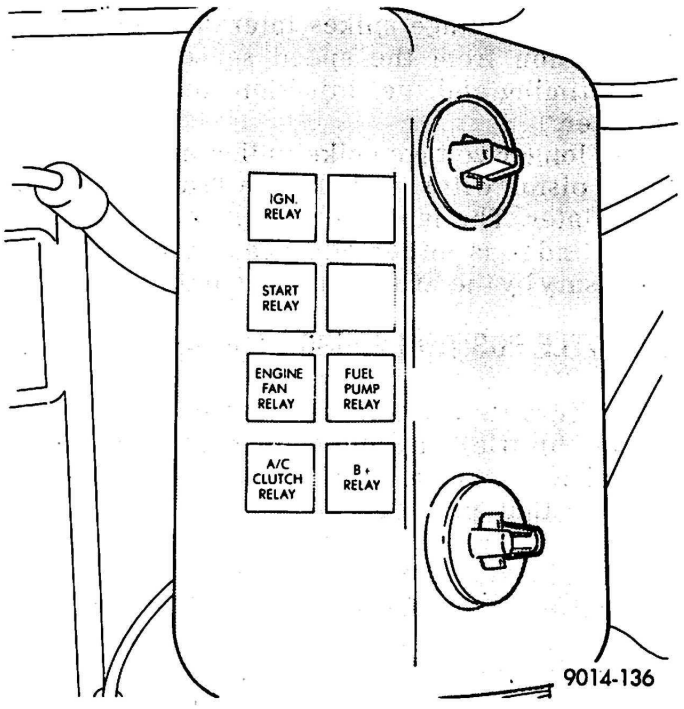


Fig. 11—Relay Cover

FUEL INJECTORS—ECU OUTPUT

The 3.0L engines Multi-Point Fuel Injection system is a simultaneous double fire type. All injectors fire simultaneously once every engine revolution, delivering half of the fuel needed for combustion. Since two engine revolutions are required to complete one engine cycle, the injectors fire twice every cycle. Hence the term "simultaneous double fire."

The fuel injectors spray fuel into each intake manifold runner above the intake valve ports in the cylinder heads (Fig. 12). There is one injector per engine cylinder. The ground path for the injectors is controlled by the ECU, while battery voltage is supplied through the fuel pump relay. When the ECU determines that it is time to operate the injectors, it supplies a ground for the injectors and all six injectors fire simultaneously. The ECU constantly adjusts the amount of fuel injected to meet changing operating conditions by controlling injector pulse width (the length of time the injector is energized).

IDLE SPEED REGULATOR—ECU OUTPUT

The idle speed regulator allows a controlled amount of air from the air cleaner to reach the intake manifold during closed throttle conditions to maintain engine idle. The inlet side of the

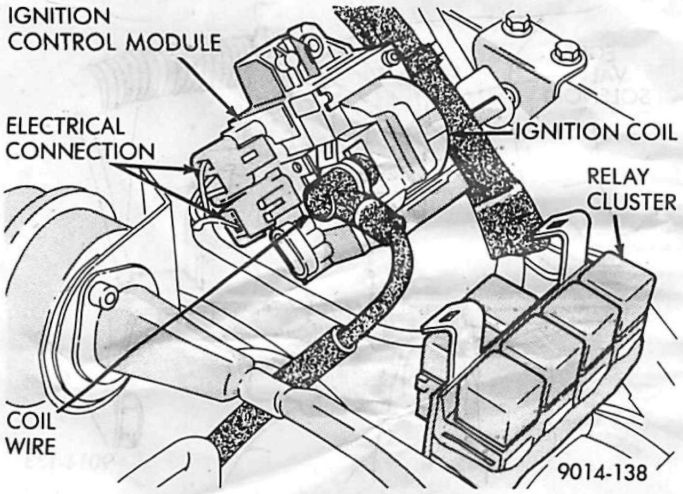


Fig 15—Ignition Control Module

When the engine is at wide open throttle, a time when the engine needs maximum power, the ECU sends a signal to the ACM to disengage the A/C compressor clutch. Refer to group 24 for further information regarding the ACM.

THROTTLE BODY

Filtered air from the air cleaner enters the intake manifold through the throttle body. Fuel does not enter the intake manifold through the throttle body, fuel is sprayed into the manifold by the fuel injectors. The throttle body, which is mounted on an adapter at the rear of the intake manifold, supplies air for above closed throttle operating conditions (Fig. 16). During closed throttle conditions air is supplied through the idle speed regulator (refer to Idle Speed Regulator—ECU OUTPUT). The throttle body is not controlled by the ECU.

The throttle position sensor is attached to the throttle body. The accelerator cable, throttle valve cable and cruise control cable are connected to the throttle lever.

FUEL RAIL

The fuel rail, which supplies fuel to the injectors and is mounted to the intake manifold (Fig. 17), consists of two rails that are connected to each other by a non-replaceable reinforced hose that is pressed onto nipple ends on both rails. One rail supplies fuel to injectors 1, 2, and 3 while the other supplies fuel to injectors 4, 5 and 6.

The fuel pressure regulator is attached to the rail which supplies injectors 4, 5, and 6. It is connected to the outlet end of the rail that supplies fuel to injectors 1, 2, and 3 by a non-replaceable reinforced hose.

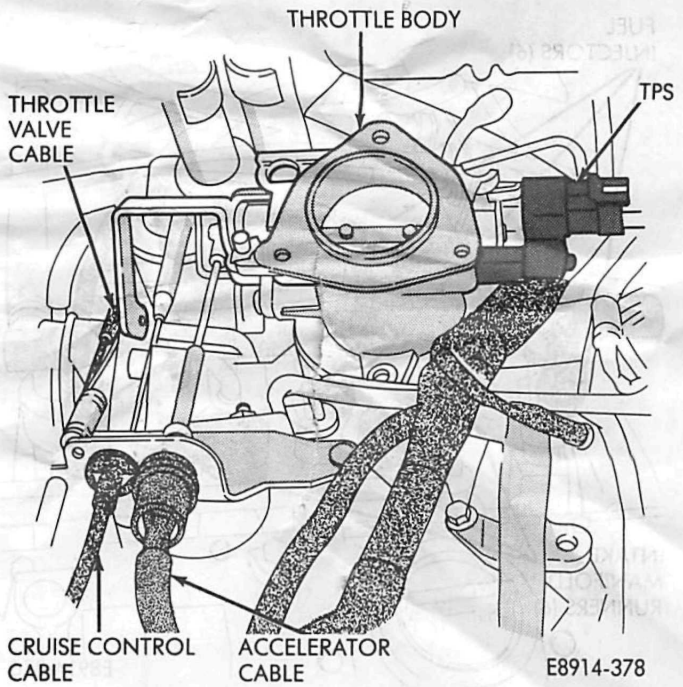


Fig. 16—MPI Throttle Body

The fuel rail and hoses are not repairable. They **MUST** be replaced as an assembly. The fuel pressure regulator is replaceable *and* can be removed from the fuel rail.

FUEL PRESSURE REGULATOR

The fuel pressure regulator used with the MPI fuel system is a vacuum assisted, non-adjustable type. The regulator is mounted on the intake manifold and is connected to the output end of the fuel rail by a non-replaceable reinforced hose. The pressure regulator is connected to intake manifold vacuum by a hose (Fig. 18). The regulator is calibrated to maintain fuel system pressure at approximately 193-207 kPa (28-30 psi) with vacuum applied while the engine is at idle. Fuel pressure will be slightly higher if vacuum is not applied to the regulator.

MODES OF OPERATION

As input signals to the ECU change, the ECU adjusts its response to the output devices. For example, the ECU must calculate a different injector pulse width and ignition timing for idle than it does for wide open throttle (WOT). There are eight different modes of operation that determine how the ECU responds to the various input signals.

Modes of operation are of two different types. OPEN LOOP and CLOSED LOOP.

During OPEN LOOP modes the ECU receives input signals and responds only according to pre-

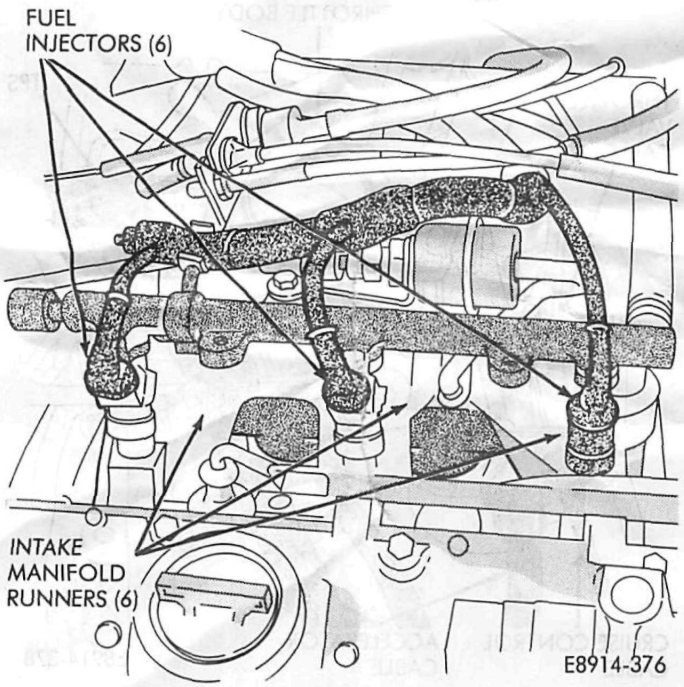


Fig. 12—Fuel Injectors, 4,5,6

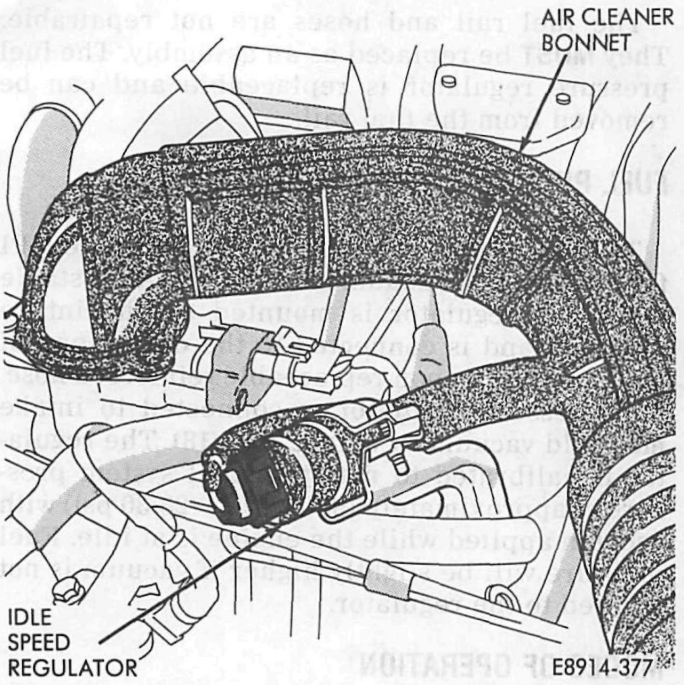


Fig. 13—Idle Speed Regulator

regulator is connected to the air cleaner bonnet, while the outlet side is connected to the throttle body adapter below the throttle plate by a hose (Fig. 13).

The idle speed regulator consists of a permanent magnet motor that operates a vane type valve. The ECU controls the amount of air routed through the regulator by opening and closing the valve. Voltage is supplied to the idle speed regulator through the B+ Latch relay, while the ECU controls the ground path to extend or retract (open or close) the valve.

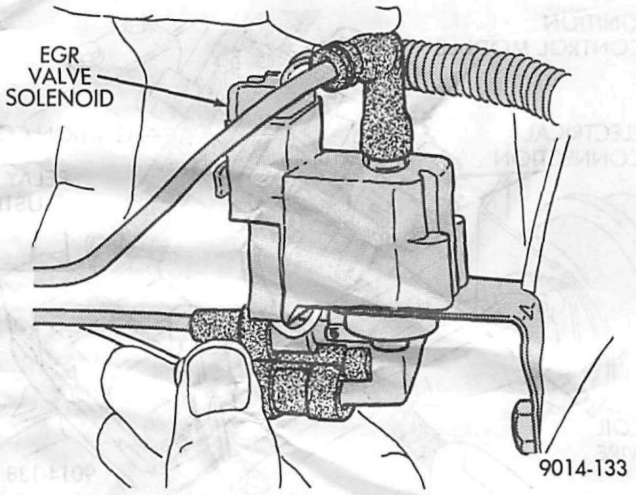


Fig. 14—EGR Valve Solenoid

EGR VALVE SOLENOID—ECU OUTPUT

Vacuum for the EGR valve function is controlled by the EGR valve solenoid. The solenoid is mounted to the left inner fender panel below the ignition control module (Fig. 14).

When the solenoid is energized by the ECU, it prevents vacuum from reaching the EGR valve transducer and EGR valve. The solenoid is energized during engine warm-up, closed throttle (idle), wide open throttle and rapid acceleration/deceleration. **If the solenoid wire connector is disconnected, the EGR valve function will be operational at all times, resulting in poor engine idle, performance, and driveability.**

IGNITION CONTROL MODULE—ECU OUTPUT

The ignition control module is mounted to the ignition coil (Fig. 15). Based on control system inputs, the ECU triggers the ignition coil via the ignition control module. The ECU is able to advance or retard ignition timing by controlling the ignition coil through the ignition control module.

AIR CONDITIONING CONTROL MODULE—ECU OUTPUT

During normal engine operation with the A/C selected, the Air Conditioning Control Module (ACM) sends a signal to the ECU indicating that the A/C has been selected. The ECU in turn adjusts idle speed to compensate for the increased engine load from the A/C compressor clutch (Refer to Air Conditioning Select and Predict Signals —ECU INPUT).

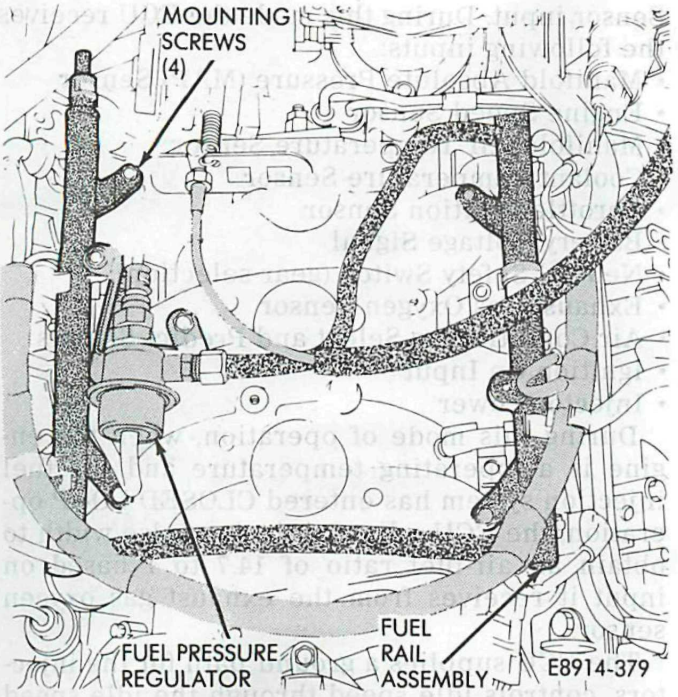


Fig. 17—Fuel Rail Assembly

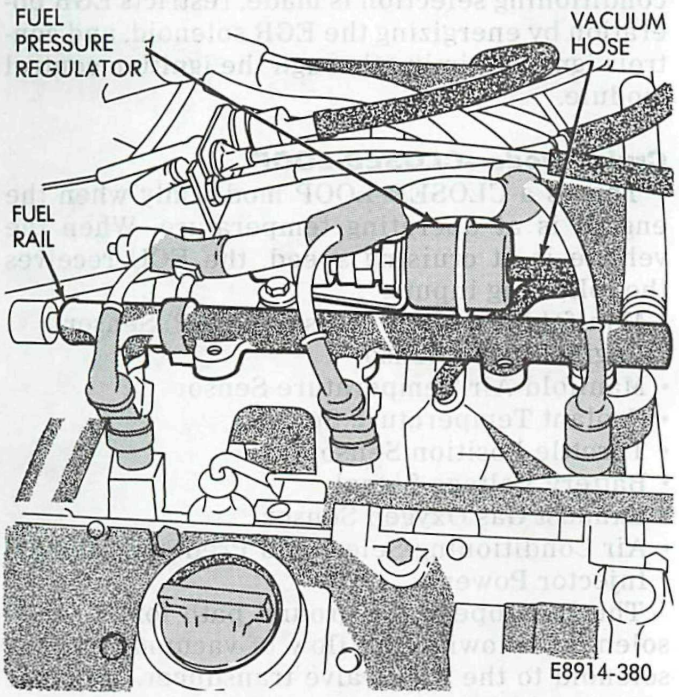


Fig. 18—MPI Fuel Pressure Regulator

set ECU programming. Input from the exhaust gas oxygen (O_2) sensor is not monitored during OPEN LOOP modes.

During CLOSED LOOP modes the ECU does monitor the exhaust gas oxygen (O_2) sensor input. This input indicates to the ECU whether or not the calculated injector pulse width results in the ideal air-fuel ratio of 14.7 parts air to 1 part fuel. By monitoring the oxygen content in the exhaust gas through the O_2 sensor, the ECU can "fine tune" the injector pulse width to achieve optimum fuel economy combined with low emission engine performance.

The MPI system has the following modes of operation:

- Ignition switch ON
- Engine start-up (crank)
- Engine warm-up
- Idle
- Cruise
- Deceleration
- Wide open throttle (WOT)
- Ignition switch OFF

The ignition switch on, engine start-up (crank), engine warm-up, deceleration, and wide open throttle modes are OPEN LOOP modes. The idle and cruise modes, **with the engine at operating temperature** are CLOSED LOOP modes.

Ignition Switch ON Mode—OPEN LOOP

This is an OPEN LOOP mode. When the ignition switch is placed in the ON position, before cranking, the ECU receives information from the following system inputs:

- Manifold Absolute Pressure (MAP) Sensor
- Coolant Temperature Sensor
- Manifold Air Temperature Sensor
- Throttle Position Sensor (TPS)
- Battery Voltage Signal

Voltage is supplied to the fuel pump relay and the ECU completes the pump relay ground circuit for 1 to 3 seconds to pressurize the fuel system. The power latch relay is energized for 1 to 3 seconds and the ECU stores a barometric pressure value in preparation for engine start-up. The ECU opens the Idle Speed Regulator. The heating element in the Oxygen Sensor is activated by the ECU through the ignition ON relay via the ignition switch. The EGR solenoid is energized by the ECU which restricts EGR operation at this time. The fuel pump relay supplies voltage to the injectors but the ECU does provide a ground path, preventing injector operation.

Engine Start-up Mode—OPEN LOOP

This is an OPEN LOOP mode. During engine cranking, the ECU receives the following inputs:

- Manifold Absolute Pressure (MAP) Sensor
- Manifold Air Temperature Sensor
- Coolant Temperature Sensor
- Throttle Position Sensor
- Battery Signal
- Engine Speed Sensor
- Engine Crank Signal
- Ignition ON Input
- Injector Power

The ECU restricts EGR operation by energiz-

ing the EGR solenoid. Voltage is supplied to the injectors for simultaneous injection. The ECU controls injector pulse width by controlling the length of time that it supplies a ground path for the injector circuit. The ECU controls ignition timing through the ignition control module and ignition coil based on input received from the engine speed sensor.

If a wide open throttle (WOT) condition occur during this mode, the ECU assumes that a flooding condition exists and will open all circuits to the injectors, preventing fuel spray to the cylinders. As long as this WOT condition exists, the injectors will not be energized by the ECU.

Engine Warm-up Mode—OPEN LOOP

This is an OPEN LOOP mode. During engine warm up the ECU receives the following inputs:

- Manifold Absolute Pressure (MAP) Sensor
- Manifold Air Temperature Sensor
- Coolant Temperature Sensor
- Throttle Position Sensor (TPS)
- Battery voltage signal
- Neutral Safety Switch (gear selection)
- Air Conditioning Select and Predict Signals
- Ignition ON input
- Injector Power

During this mode of operation the ECU restricts EGR operation by energizing the EGR solenoid, voltage is supplied to the injectors for simultaneous injection, and injector pulse width is controlled by the ECU through control of the ground path for the injector circuit.

The ECU establishes the proper idle speed by providing a ground path for the idle speed regulator. The ECU controls ignition timing through the ignition control module based on various sensor inputs. If an engine knock is detected by the knock sensor, the ECU will retard ignition timing until the knock is eliminated. Following the elimination of the knock, ignition timing will gradually be returned to its prior value.

Also, during this mode of operation, the throttle position sensor provides input to the ECU relating to throttle position. The throttle position input is used in conjunction with other sensor inputs to determine correct injector pulse width and ignition timing. If, during this mode, the ECU receives a select signal from the Air Conditioning Control Module (ACM), the ECU adjusts idle speed to compensate for increased engine load.

Idle Mode—CLOSED LOOP

This is a CLOSED LOOP mode only when the engine is at operating temperature. During this mode, the ECU responds to Exhaust Gas Oxygen Sensor input. During this mode the ECU receives the following inputs:

- Manifold Absolute Pressure (MAP) Sensor
- Engine Speed Sensor
- Manifold Air Temperature Sensor
- Coolant Temperature Sensor
- Throttle Position Sensor
- Battery Voltage Signal
- Neutral Safety Switch (gear selection)
- Exhaust Gas Oxygen Sensor
- Air Conditioning Select and Predict Signals
- Ignition On Input
- Injector Power

During this mode of operation, when the engine is at operating temperature and the fuel injection system has entered CLOSED LOOP operation, the ECU adjusts injector pulse width to obtain an air-fuel ratio of 14.7 to 1 based on input it receives from the exhaust gas oxygen sensor.

The ECU supplies a ground path for the injectors, controls idle speed through the idle speed regulator, adjusts injector pulse width if an air conditioning selection is made, restricts EGR operation by energizing the EGR solenoid, and controls ignition timing through the ignition control module.

Cruise Mode—CLOSED LOOP

This is a CLOSED LOOP mode only when the engine is at operating temperature. When the vehicle is at cruising speed, the ECU receives the following inputs:

- Manifold Absolute Pressure (MAP) Sensor
- Engine Speed Sensor
- Manifold Air Temperature Sensor
- Coolant Temperature Sensor
- Throttle Position Sensor
- Battery Voltage Signal
- Exhaust Gas Oxygen Sensor
- Air Conditioning Select and Predict Signals
- Injector Power

The ECU opens the ground path for the EGR solenoid, allowing the flow of vacuum from the solenoid to the EGR valve transducer. If engine speed and load result in enough exhaust system back pressure to close the transducer, vacuum flow to the EGR valve.

The ECU monitors the exhaust gas oxygen sensor and adjusts injector pulse width to obtain a 14.7 to 1 air fuel ratio. All injectors fire simultaneously.

The ECU controls ignition timing through the ignition control module.

Deceleration Mode—OPEN LOOP

This is an OPEN LOOP mode. During this mode of operation, the ECU ignores the exhaust gas oxygen sensor input. The ECU receives the following inputs:

- Manifold Absolute Pressure (MAP) Sensor
- Engine Speed Sensor
- Manifold Air Temperature Sensor
- Coolant Temperature Sensor
- Throttle Position Sensor (TPS)
- Battery Voltage Signal
- Air Conditioning Select and Predict Signals

If the ECU receives a closed throttle signal from the TPS while the engine speed is over 1200 rpm, the ECU will determine that the engine is in hard deceleration and in response stop fuel injection and suspend EGR operation. The ECU continue injection once the closed throttle conditions no longer exists or when engine speed is below 1200 rpm.

If the ECU detects only a gradual deceleration it will adjust injector pulse width based on inputs from the engine control system sensors.

Wide Open Throttle Mode—OPEN LOOP

This is an OPEN LOOP mode. During wide open throttle (WOT) the ECU receives the following inputs:

- Manifold Absolute Pressure (MAP) Sensor
- Engine Speed Sensor
- Manifold Air Temperature Sensor
- Coolant Temperature Sensor
- Throttle Position Sensor (TPS)
- Battery Voltage Signal
- Ignition ON Input
- Injector Power

During wide open throttle conditions, the ECU monitors the barometric pressure of the air through the MAP sensor. Injector pulse width is adjusted by the ECU through control of the ground path for the injector circuit. The ECU controls ignition timing through the ignition control module. The ECU suspends EGR operation through control of the EGR solenoid and sends a signal to the Air Conditioning Control Module (ACM) to deactivate the air conditioning compressor clutch for 15 seconds.

Ignition Switch Off Mode—OPEN LOOP

This is an OPEN LOOP mode. When the ignition key is turned to the off position, the following takes place:

- The ECU stops providing a ground path for the injectors and fuel injection stops
- The fuel pump is de-energized
- The ignition power module is deactivated
- The ECU opens the ground circuit for the power latch relay and all voltage to the injection circuit stops.

GENERAL DIAGNOSIS

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VISUAL INSPECTION

A visual inspection for loose, disconnected, or improperly routed wires and hoses should be made before attempting to diagnose the fuel injection system. A visual check will help spot these faults and save unnecessary test and diagnostic time. A thorough visual inspection includes the following checks:

(1) Inspect battery cable connections. They should be tight. The top of the battery should be free of corrosion and grime (Fig. 19). Check the color of the test indicator on the top of the battery. Refer to group 8B.

(2) Inspect engine control system ground connections on side of frame rail between battery and air cleaner (Fig. 20).

(3) Inspect all engine control system relays connections. Inspect relays for signs of physical damage and corrosion (Fig. 21).

(4) Inspect ignition control module connections. Verify that coil wire is connected to coil (Fig. 21).

(5) Inspect the air cleaner element (filter) for blockage or clogging (Fig. 22).

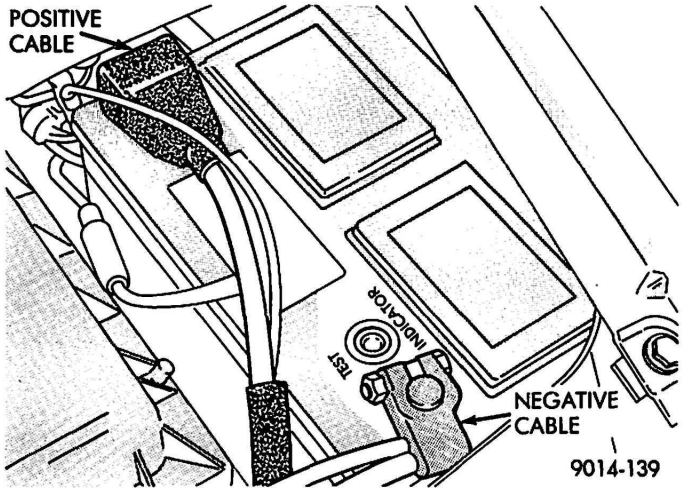


Fig. 19—Battery Cable Connections

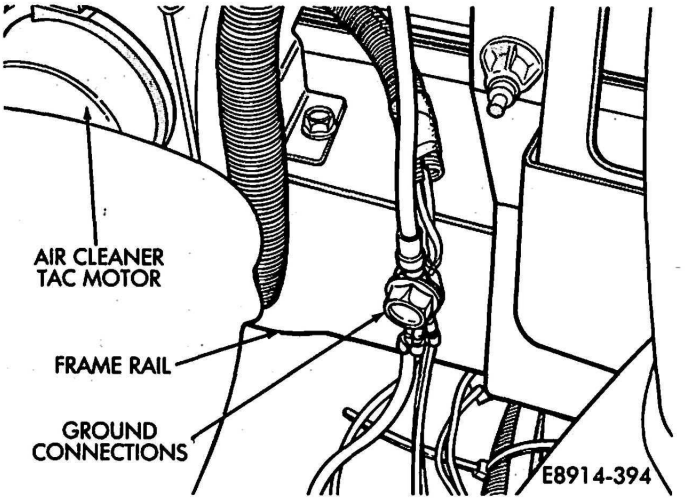


Fig. 20—Engine Control System Ground Connections

(6) Verify that the thermal vacuum switch vacuum (TVS) supply tube and the TVS to vacuum motor vacuum tube are connected to the thermal vacuum switch (TVS) in the air cleaner cover (Fig. 23).

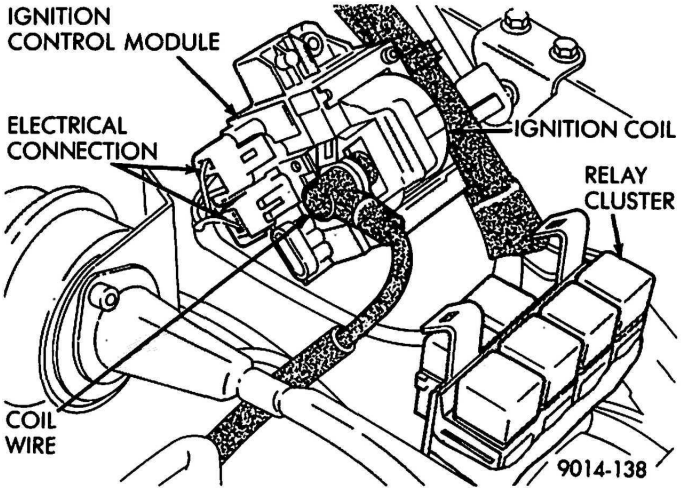


Fig. 21—Engine Control System Relays, Ignition Control Module/Ignition Coil

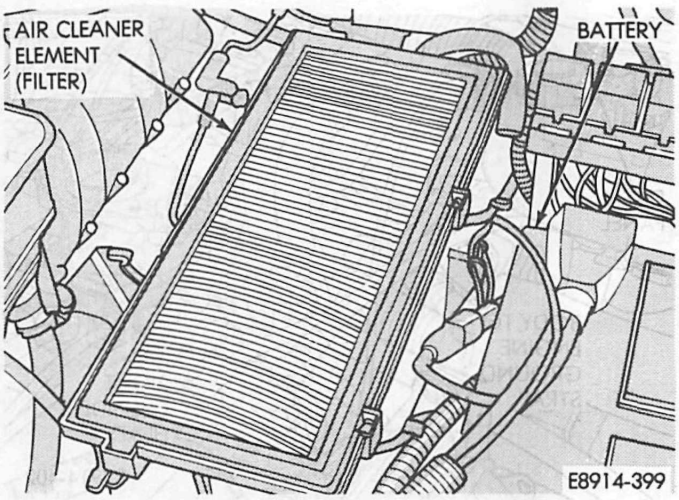


Fig. 22—Air Cleaner Element (Filter)

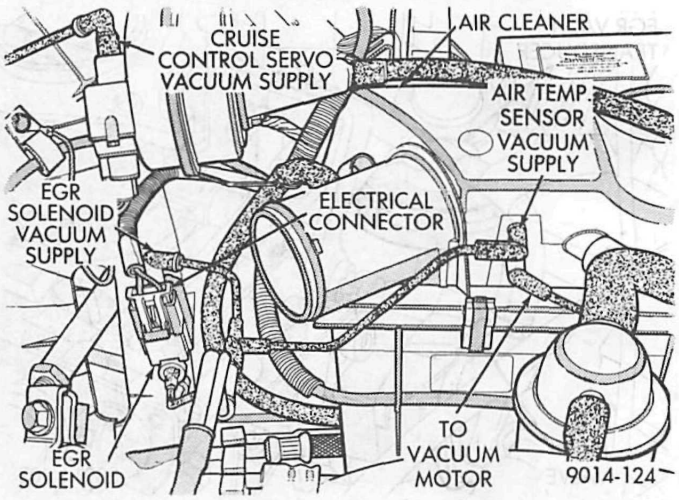


Fig. 23—TVS, EGR Solenoid and Cruise Control Servo Vacuum Tubes

(7) Inspect the vacuum tube and electrical connections at the EGR valve vacuum solenoid (Fig. 23). Ensure that they are tight.

(8) Verify that the cruise control servo vacuum supply tube is connected to the servo.

(9) Inspect the brake vacuum booster hose connections at the vacuum booster and below the throttle body (Fig. 24).

(10) Inspect the pre-heated air hose connections at the air cleaner and heat stove on the manifold. Inspect the hose for rips or tears (Fig. 25).

(11) Inspect the air cleaner ambient air opening for blockage. Ensure that the TAC vacuum motor vacuum is connected to the motor (Fig. 25).

(12) Inspect the CCV fresh air and vacuum hoses for signs of damage or fatigue. Ensure that they are connected securely (Fig. 26).

(13) Ensure that the Throttle Position Sensor (TPS) and Idle Speed Regulator electrical connectors are connected. Inspect the connections for corrosion (Fig. 27).

(14) Inspect the Idle Speed Regulator inlet and outlet hoses for fatigue (Fig. 27).

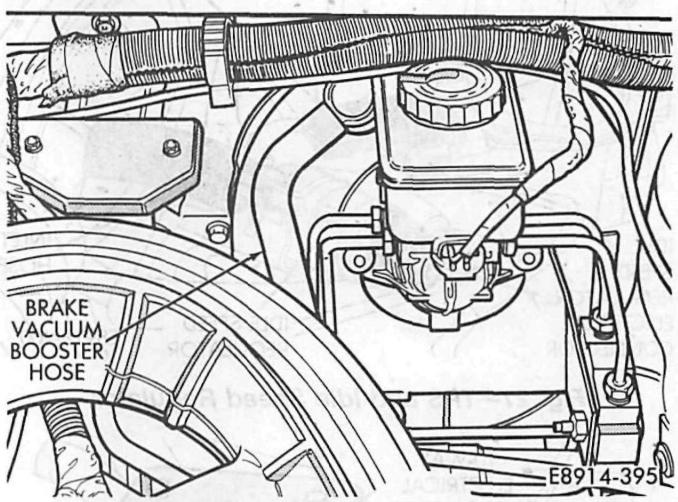


Fig. 24—Brake Vacuum Booster Hose

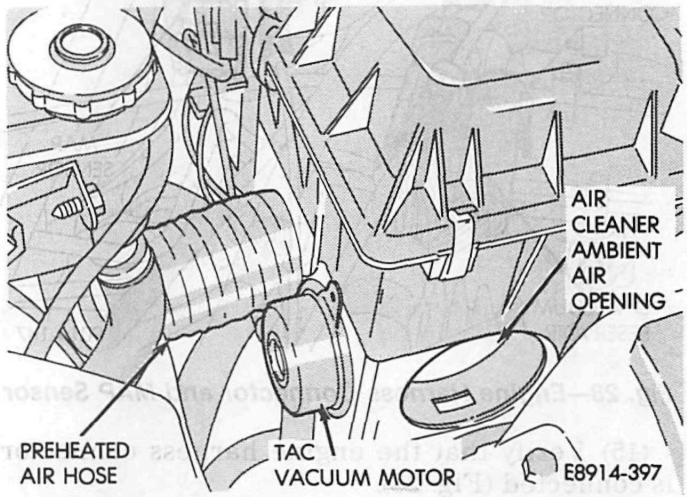


Fig. 25—Pre-heated Air Hose

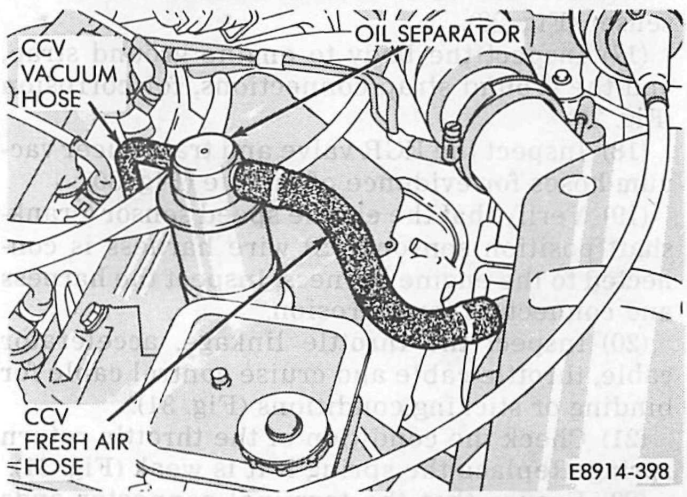


Fig. 26—CCV Hoses

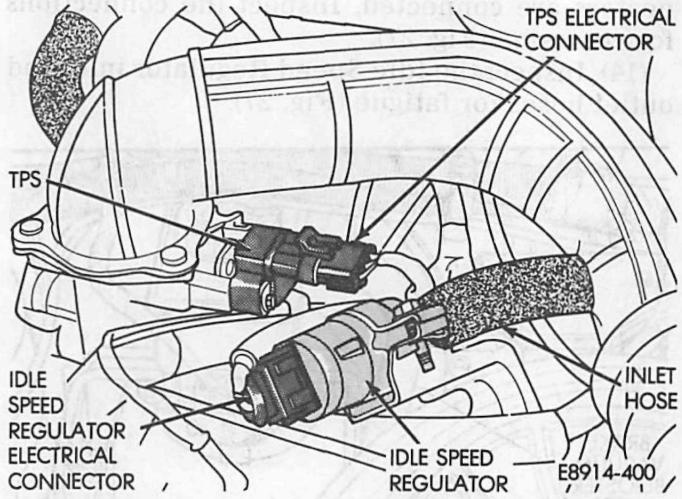


Fig. 27—TPS and Idle Speed Regulator

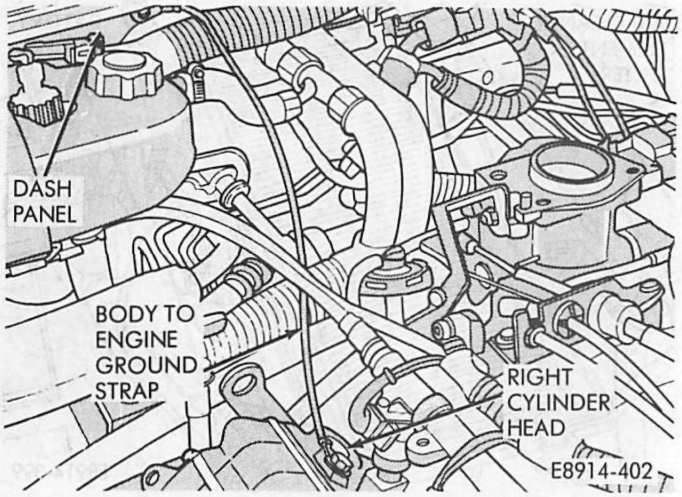


Fig. 29—Body to Engine Ground Strap

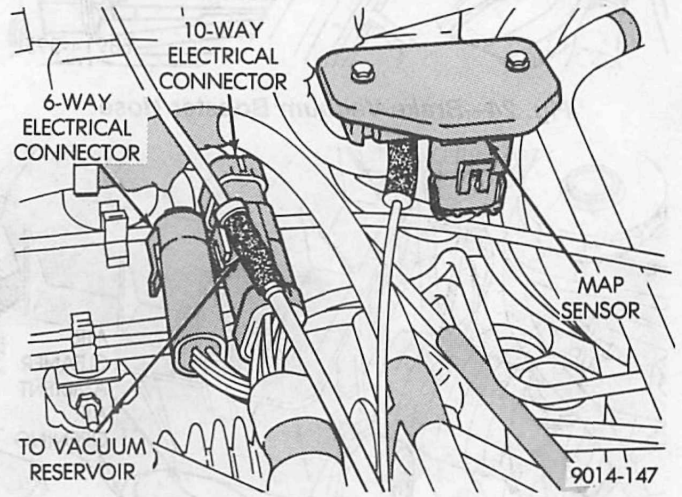


Fig. 28—Engine Harness Connector and MAP Sensor

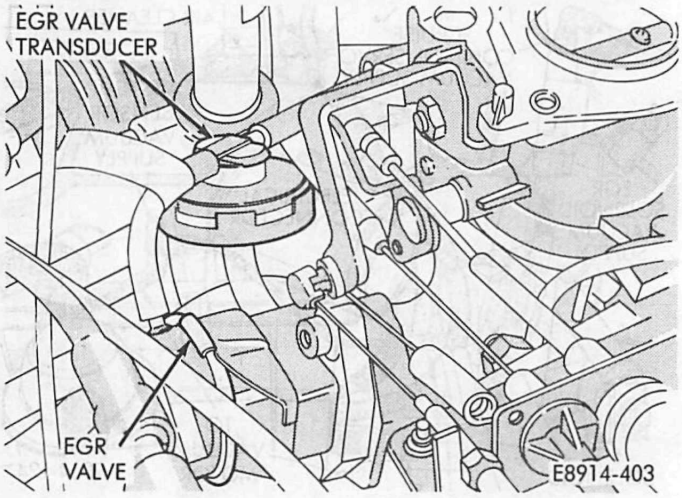


Fig. 30—EGR Valve and Transducer

(15) Verify that the engine harness connector is connected (Fig. 28).

(16) Ensure that the MAP sensor vacuum tube and electrical connector are connected to the sensor (Fig. 28).

(17) Inspect the body to engine ground strap, and the ground strap connections, for corrosion (Fig. 29).

(18) Inspect the EGR valve and transducer vacuum hoses for evidence of fatigue (Fig. 30).

(19) Verify that the engine speed sensor (crankshaft position sensor-CPS) wire harness is connected to the engine harness. Inspect the harness and connectors for corrosion.

(20) Inspect the throttle linkage, accelerator cable, throttle cable and cruise control cable for binding or sticking conditions (Fig. 31).

(21) Check the condition of the throttle return spring. Replace the spring if it is weak (Fig. 31).

(22) Ensure that the terminal connector ends in the boots of the spark plug wires are completely engaged to the terminals on the distributor cap and spark plugs (Fig. 32). Inspect for corrosion of the connectors or terminals.

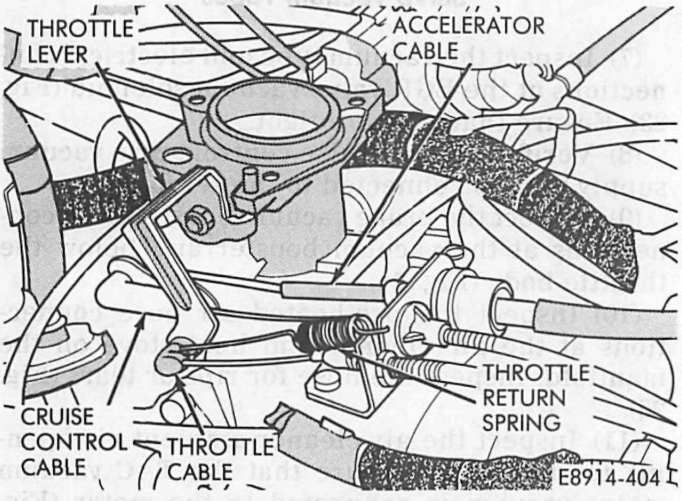


Fig. 31—Throttle Linkage

(23) Ensure that the injector harness connec-

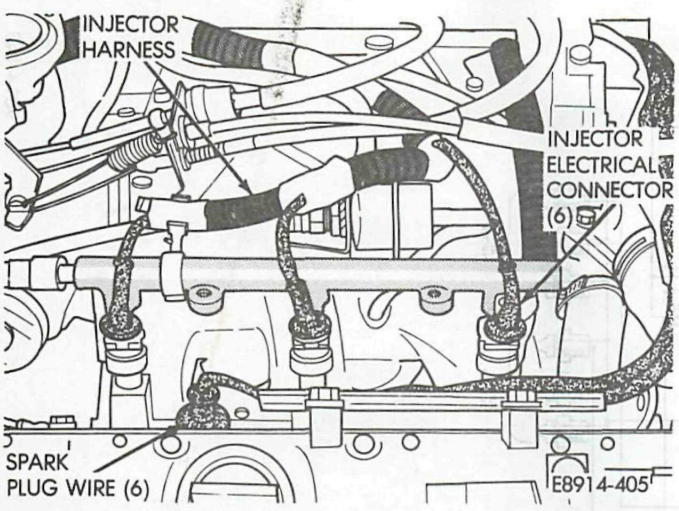


Fig. 32—Spark Plug Wires and Injector Connectors

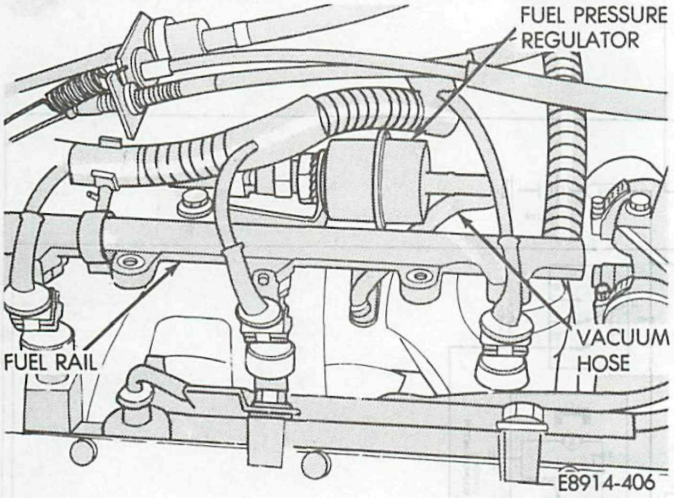


Fig. 33—Fuel Pressure Regulator Vacuum Hose

tors are completely connected to the injectors (Fig. 32). Inspect the connectors for corrosion.

(24) Inspect the fuel pressure regulator vacuum hose for fatigue or damage (Fig. 33). Replace the hose if necessary.

(25) Verify that the coolant temperature sensor electrical connector is connected to the sensor (Fig. 34). Inspect the sensor and connector for corrosion.

(26) Verify that the electric cooling fan switch connector is connected to the switch (Fig. 35). Inspect the connector and switch for corrosion.

(27) Verify that cooling fan connector is connected to harness connector (Fig. 35). Inspect connectors for corrosion.

(28) Raise vehicle and inspect starter motor connections for corrosion.

(29) Check hose and wiring connections at Fuel Pump.

COMPONENT DIAGNOSTIC PROCEDURES

This section contains information for determining individual MPI system component performance. Diagnosis of ECU/Engine Control System is performed using the DRB II Service Diagnostic Tester. Refer to the Tester Manual for the appropriate system test procedures.

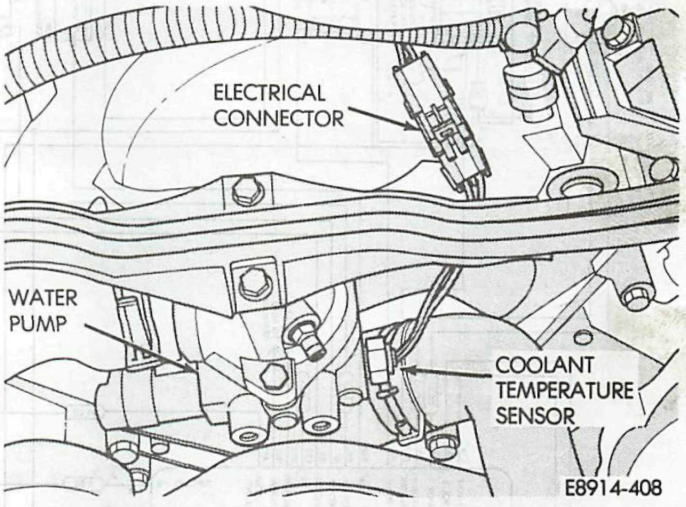


Fig. 34—Coolant Temperature Sensor

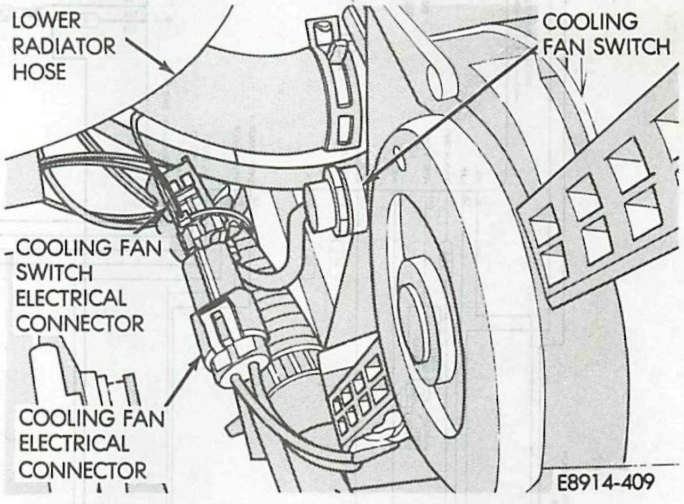
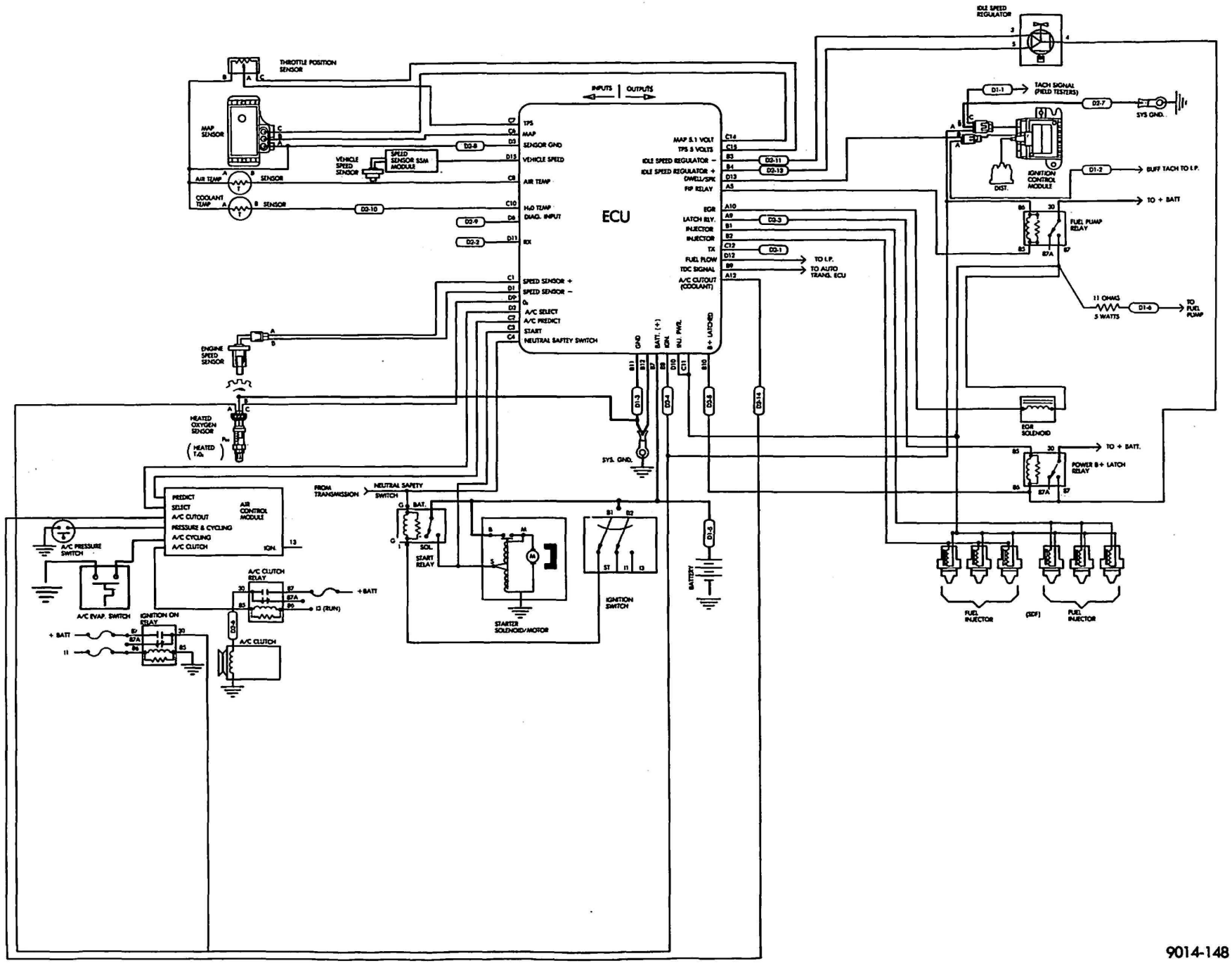
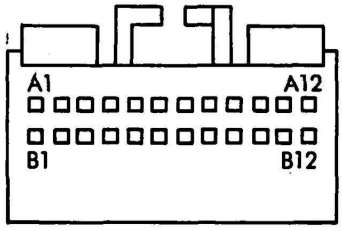
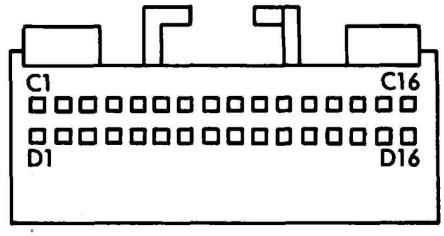


Fig. 35—Cooling Fan Switch


IDLE SPEED REGULATOR
THROTTLE POSITION SENSOR
MAP SENSOR
AIR TEMP SENSOR
COOLANT TEMP SENSOR
VEHICLE SPEED SENSOR
SPEED SENSOR SSM MODULE
INPUTS
OUTPUTS
ECU
TPS
MAP
SENSOR GND
VEHICLE SPEED
AIR TEMP
H2O TEMP
DIAG. INPUT
IDI
SPEED SENSOR +
SPEED SENSOR −
O2
A/C SELECT
A/C PREDICT
START
NEUTRAL SAFTEY SWITCH
MAP 5.1 VOLT
TPS 5 VOLTS
IDLE SPEED REGULATOR −
IDLE SPEED REGULATOR +
DWELL/SPK
FPR RELAY
EGR
LATCH RLY.
INJECTOR
INJECTOR
TX
FUEL FLOW
TDC SIGNAL
A/C CUTOUT (COOLANT)
TO I.P.
TO AUTO TRANS. ECU
GND
BATT. (+)
IGN.
INJ. PWR.
B+ LATCHED
TACH SIGNAL (FIELD TESTERS)
SYS GND.
IGNITION CONTROL MODULE
DIST.
BUFF TACH TO I.P.
TO + BATT
FUEL PUMP RELAY
11 OHMS 5 WATTS
TO FUEL PUMP
ENGINE SPEED SENSOR
HEATED OXYGEN SENSOR
EGR SOLENOID
POWER B+ LATCH RELAY
TO + BATT.
FROM TRANSMISSION
NEUTRAL SAFETY SWITCH
BAT.
SOL.
START RELAY
STARTER SOLENOID/MOTOR
IGNITION SWITCH
BATTERY
PREDICT
SELECT
A/C CUTOUT
PRESSURE & CYCLING
A/C CYCLING
A/C CLUTCH
AIR CONTROL MODULE
IGN.
A/C PRESSURE SWITCH
A/C EVAP. SWITCH
A/C CLUTCH RELAY
+ BATT
I3 (RUN)
IGNITION ON RELAY
A/C CLUTCH
FUEL INJECTOR
(SDF)
FUEL INJECTOR

9014-148





A

1. NOT USED
2. NOT USED
3. NOT USED
4. NOT USED
5. FUEL PUMP RELAY
6. NOT USED
7. NOT USED
8. NOT USED
9. LATCH RELAY
10. EGR SOLENOID
11. NOT USED
12. A/C CUTOUT (COOLANT)

B

1. INJECTOR
2. INJECTOR
3. IDLE SPEED REGULATOR (-)
4. IDLE SPEED REGULATOR (+)
5. NOT USED
6. NOT USED
7. BATTERY (+)
8. IGNITION
9. TDC SIGNAL—TO TCU
10. LATCHED B+
11. GROUND
12. GROUND

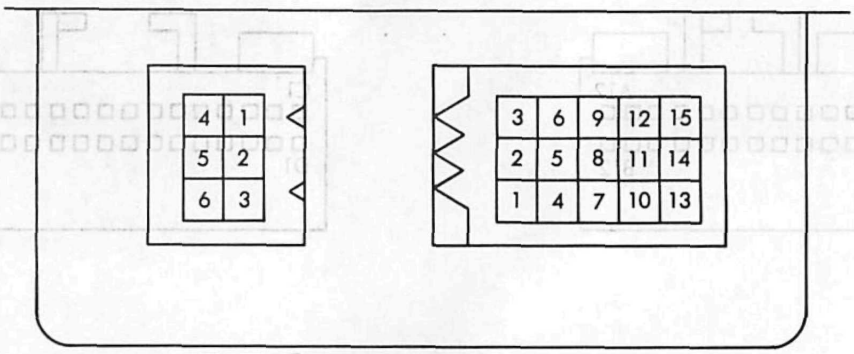
C

1. SPEED SENSOR (+)
2. A/C PREDICT
3. START
4. P/N SWITCH
5. NOT USED
6. MAP SENSOR
7. TPS SENSOR
8. AIR TEMPERATURE SENSOR
9. NOT USED
10. COOLANT TEMPERATURE SENSOR
11. INJECTION SUPPLY
12. TX (SERIAL DATA)
13. NOT USED
14. MAP SENSOR SUPPLY (+)
15. TPS SUPPLY (+)
16. NOT USED

D

1. SPEED SENSOR (-)
2. A/C SELECT
3. SENSOR GROUND
4. NOT USED
5. NOT USED
6. DIAGNOSTIC INPUT
7. NOT USED
8. NOT USED
9. OXYGEN SENSOR INPUT
10. INJECTION SUPPLY
11. RX (SERIAL DATA)
12. FUEL FLOW—TO I.P.
13. SPARK/DWELL
14. NOT USED
15. VEHICLE SPEED
16. NOT USED

9014-149



CONNECTOR D1

1. TACH SIGNAL
2. BUFF TACK SIGNAL
3. POWER GROUND
4. TRANS. MALFUNCTION LIGHT
5. BATTERY
6. FUEL PUMP RELAY

CONNECTOR D2

1. ECU OUTPUT (TX)
2. RX DATA (ECU)
3. LATCH RELAY
4. IGNITION
5. B+ LATCH
6. A/C CLUTCH RELAY
7. SYSTEM GROUND
8. SENSOR GROUND
9. DIAGNOSTIC INPUT
10. ECU COOLANT SENSOR
11. IDLE SPEED REGULATOR (-)
12. NOT USED
13. IDLE SPEED REGULATOR (+)
14. A/C CONTROL MODULE
15. TCU DATA OUT

E8914-381

Diagnostic Connectors

The diagnostic connectors are located in the engine compartment. The connectors are protected by black rubber covers. Cavity identification and specific engine function is listed in connector illustration.

Coolant Temperature Sensor Test

Disconnect wire harness connector from coolant temperature sensor (Fig. 36).

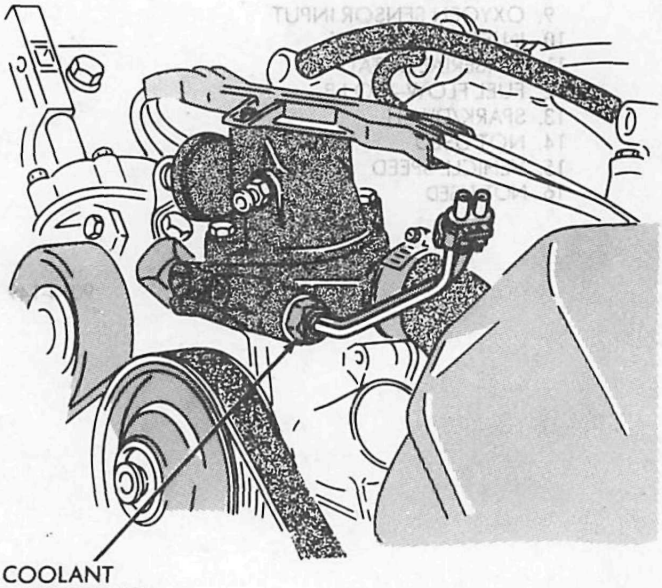


Fig. 36—Coolant Temperature Sensor

Test the resistance of the sensor with a high input impedance (digital) volt-ohmmeter. The resistance should be less than 1000 ohms with the engine warm. Refer to the resistance chart. Replace the sensor if it is not within the range of resistance specified in the chart.

Test the resistance of the wire harness between ECU wire harness connector terminal D-3 and the sensor connector terminal, and wire harness terminal C-10 to the sensor connector terminal. Repair the wire harness if the resistance is greater than one ohm.

Coolant Temperature Sensor Temperature-to-Resistance Values (Approximate)

°F	°C	Ohms
212	100	185
160	70	450
100	38	1,600
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

J8914-89

Manifold Air/Fuel Temperature (MAT) Sensor Test

Disconnect the wire harness connector from the MAT sensor (Fig. 37).

Test the resistance of the sensor with a high impedance (digital) volt-ohmmeter. The resistance should be less than 1000 ohms with the engine warm. Refer to the resistance chart. Replace the sensor if it is not within the range of resistance specified in the chart.

Test the resistance of the wire harness between the ECU wire harness connector terminal D-3 and the sensor connector terminal, and terminal C-8 to the sensor connector terminal. Repair the wire harness as necessary if the resistance is greater than 1 ohm.

Manifold Absolute Pressure (MAP) Sensor Test

Inspect the MAP sensor vacuum hose connections at the throttle body and sensor. Repair as necessary.

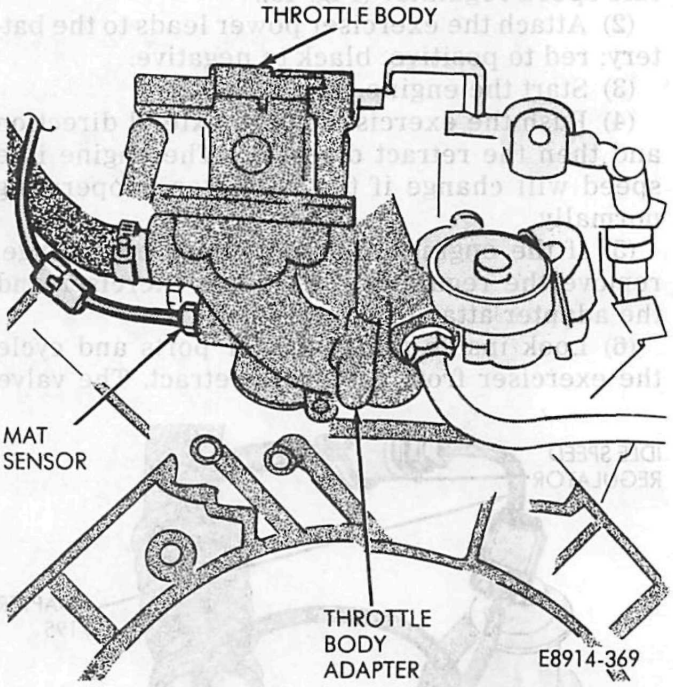


Fig. 37—Manifold Air Temperature Sensor

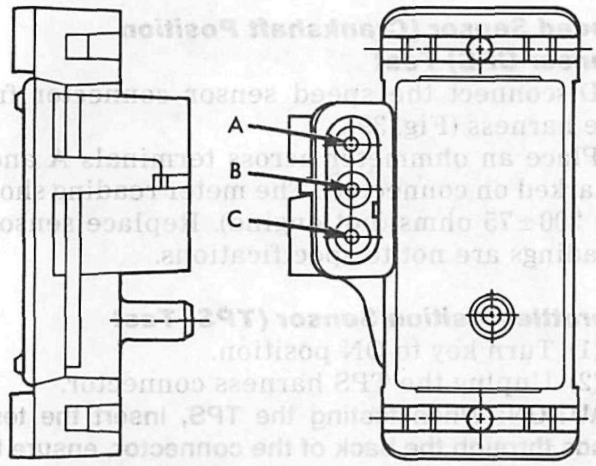
CAUTION: When testing the MAP sensor, insert the tester leads through the back of the connector, ensure that the harness wires are not damaged by the test meter leads.

Test the MAP sensor output voltage at the MAP sensor connector terminal B (as marked on the sensor body) with the ignition switch ON and the engine OFF (Fig. 39). Output voltage should be 4–5 volts. Start the engine and allow idle to stabilize. Recheck output voltage at terminals B. The voltage should drop to 1.5–2.1 volts with a hot, neutral idle speed condition.

Manifold Air/Fuel Temperature Sensor Temperature-to-Resistance Values (Approximate)

°F	°C	Ohms
212	100	185
160	70	450
100	38	1,600
70	20	3,400
40	4	7,500
20	–7	13,500
0	–18	25,000
–40	–40	100,700

J8914-90



A. Ground
B. Output Voltage
C. 5 Volts

J8914-91

Fig. 38—MAP Sensor Connector Terminals

Test ECU terminal C-6 for the same voltage described above to verify the wire harness condition. Repair as necessary.

Test MAP sensor supply voltage at sensor connectot terminal C with the ignition ON. The voltage should be 5 volts (±0.5V). Five volts (±0.5V) should also be at terminal C-14 of the ECU wire harness connector. Repair or replace the wire harness as necessary.

Test the MAP sensor ground circuit at sensor connector terminal A and ECU connector terminal D-3. Repair the wire harness if necessary.

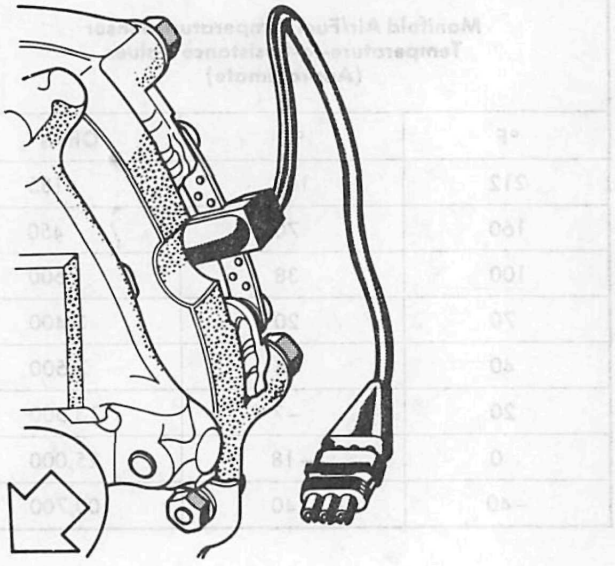


Fig. 39—Engine Speed Sensor

Speed Sensor (Crankshaft Position Sensor-CPS) Test

Disconnect the speed sensor connector from the harness (Fig. 39).

Place an ohmmeter across terminals A and B (marked on connector). The meter reading should be 200±75 ohms (hot engine). Replace sensor if readings are not to specifications.

Throttle Position Sensor (TPS) Test

(1) Turn key to ON position.

(2) Unplug the TPS harness connector.

CAUTION: When testing the TPS, insert the tester leads through the back of the connector, ensure that the harness wires are not damaged by the test meter leads.

(3) Measure voltage between connector terminal C and B of the TPS harness connector with a high impedance digital volt-ohmmeter.

• Meter should register approximately 5 volts. If voltage is incorrect, test the vehicle using the DRB II tester.

(4) Turn the ignition key to the OFF position.

(5) Test for continuity between TPS connector pin B and ground using a high-impedance digital volt-ohmmeter.

• If circuit is open, test the vehicle with the DRB II tester.

(6) Reconnect TPS connector.

(7) Turn Key to ON position.

(8) Back probe TPS connector with a high impedance digital volt-meter (such as tool number C4845 or an equivalent) and measure voltage from terminal A and ground.

• Meter should register approximately 0.5 to 1.0 volts. If voltage is incorrect, attempt to adjust the TPS using either the method in the MPI Service Adjustments section of this group, or using the DRB II tester. If the sensor cannot be adjusted, the sensor is defective and should be replaced.

Exhaust Gas Oxygen (O_2) Sensor Heating Element Test

The oxygen sensor heating element can be tested with an ohmmeter as follows:

Disconnect the O_2 sensor connector. Connect the ohmmeter test leads to connector terminals A and B of the sensor connector. Resistance should be less than 10 ohms. Replace the sensor if the ohmmeter displays an infinity reading.

Idle Speed Regulator

(1) Attach the adapter harness, tool number 7195 to Idle Speed Exerciser tool 7088 and to the idle speed regulator (Fig. 40).

(2) Attach the exerciser power leads to the battery; red to positive, black to negative.

(3) Start the engine.

(4) Push the exerciser in the extend direction and then the retract direction. The engine idle speed will change if the regulator is operating normally.

(5) If the engine idle speed does not change, remove the regulator. Leave the exerciser and the adapter attached.

(6) Look inside the regulator ports and cycle the exerciser from extend to retract. The valve

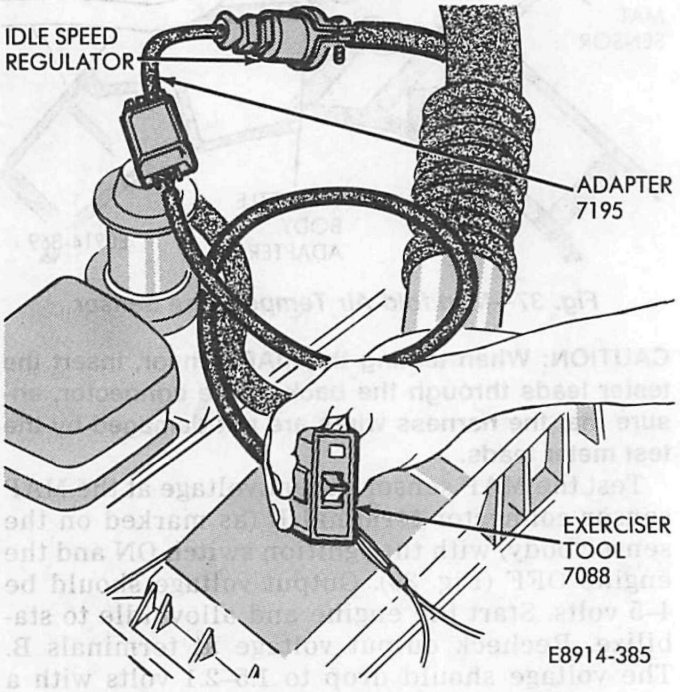


Fig. 40—Idle Speed Regulator Testing

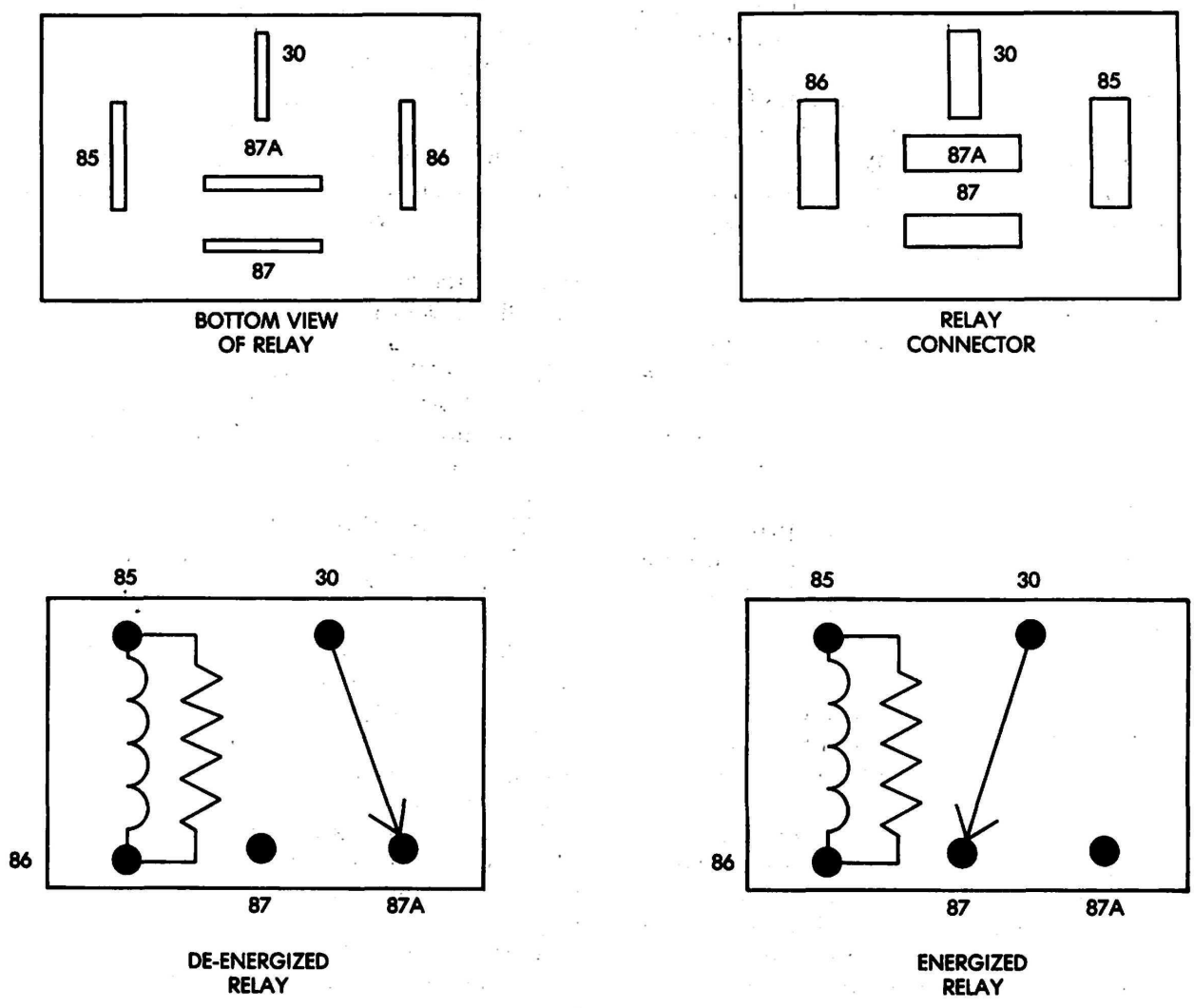


Fig. 41—Relay Terminals

inside should open and close while cycling the exerciser. If it does not, replace the idle speed regulator.

Relay Operation/Testing

Operation

- Terminal No. 30 is usually connected to battery voltage and can be switched or B+ at all times (Fig. 42).
- Terminal No. 87A is connected to terminal 30 in the de-energized position. (Fig. 41).
- Terminal No. 87 is connected to terminal 30 in the energized position which supplies battery voltage to the operated device (Fig. 41).
- Terminal No. 86 is connected to the electromagnet and usually connected to a switched power source (Fig. 41).
- Terminal No. 85 is connected to the electromagnet and is usually grounded by a switch or ECU (Fig. 41).

Testing

• A relay in the de-energized position should have continuity between terminal 87A and terminal 30.

• Resistance value between terminals 85 and 86 (electromagnet) is 75±5 ohms for resistor relays and 86±5 ohms for diode relays.

Not all relays have battery voltage connected to terminal No. 30. Some may have battery voltage connected to terminals 87 or 87A.

EGR Solenoid Test

(1) Unplug solenoid electrical connector.

(2) Connect a 12 volt source to one of the solenoid terminals.

(3) Connect and Disconnect a ground to the other solenoid terminal.

• If the solenoid clicks each time the ground is provided, the solenoid is operating properly.

• If the solenoid does not click when the ground is provided, the solenoid is not operating correctly and should be replaced.

Injector Test

(1) Check system fuel pressure. The fuel pressure should be between 193-207 kPa (28-30 psi). Repair fuel supply system if fuel pressure is not within specifications.

(2) If fuel pressure is within specifications, start the vehicle and disconnect the fuel injector electrical connectors one at a time while observing engine rpm on a tachometer. An injector that is not operating will not cause the engine rpm to change when its' electrical connector is disconnected. If rpm does change, injectors are firing.

(3) If an injector is found not to be operating, measure the resistance between injectors terminals with an ohmmeter. There should be approximately 2.4 ohms resistance (at 20°C–68°F). Replace the injector if resistance is not within specifications.

(4) If resistance is within specifications, connect a 12 volt test lamp across the injector connector terminals (wire harness side). Observe the test lamp while cranking the engine. If the test lamp flashes on and off proceed to step (5). If the test lamp does not flash on and off, proceed to (a).

(a) Check the power and ground circuits to the injector. Refer the wiring diagrams. If the circuits are not OK, repair as necessary. If the circuits are OK, test the vehicle with the DRB-II tester.

(5) Remove the suspect injector from the fuel rail and intake manifold. Inspect the injector inlet for blockage. If the injector inlet is plugged, replace the injector. If the inlet is not plugged, proceed to (6).

(6) Inspect the fuel supply line and fuel rail for blockage. Repair as necessary. If blockage is not found, proceed to (7).

(7) Connect a 12 volt source to one of the terminals on the injector. Repeatedly connect and disconnect a ground source to the other terminal. The injector should click each time the ground is supplied. Replace the injector if it does not click when the ground is supplied.

Fuel Pressure Test

WARNING: WEAR EYE PROTECTION WHEN SERVICING THE FUEL SYSTEM. DO NOT SMOKE OR ALLOW OPEN FLAME NEAR FUEL SYSTEM COMPONENTS DURING FUEL SYSTEM SERVICE.

(1) Remove the fuel tank filler cap to relieve the fuel tank pressure.

WARNING: SYSTEM FUEL PRESSURE WILL BE RELEASED WHEN DISCONNECTING THE FUEL SUPPLY TUBE. WRAP SHOP TOWELS AROUND THE TUBE AND QUICK-CONNECT FITTING TO ABSORB SPILLED FUEL.

(2) Use tool 6182 to remove the black fuel supply tube from the fuel rail (Fig. 42). Slide the tool over the nipple and up into the connector until the handle fits the connector. Pull the fuel supply tube off of the fuel rail.

(3) Install fuel line adaptor, tool number 6175.

(4) Push the female end with the quick-connect fitting over the fuel rail until a click is heard. Pull the connector back to ensure that it is locked in place.

(5) Push the male end with the nipple into the black fuel supply tube until a click is heard. Pull the nipple back to ensure that it is locked in place.

(6) Attach the 0-60 psi gauge from fuel gauge set 5069 or equivalent to the port on fuel tube adapter 6175.

(7) Start the engine and check the fuel pressure. It should be 193-207 kPa (28-30 psi).

The fuel pressure regulator is non-adjustable.

(8) If the fuel pressure is low, check for fuel flow through the return tube.

• If fuel is returning to the fuel tank through the fuel return tube, replace the fuel pressure regulator.

• If fuel is not returning to the fuel tank through the return tube, inspect for faulty fuel pump, possible clogged fuel filter or other restrictions between the fuel pressure regulator and the fuel pump.

(9) If the fuel pressure is high, check the pressure regulator vacuum hose for leaks and for a kink or restriction in the fuel return tube. If the pressure regulator vacuum hose is not leaking and the return tube is not kinked or does not

have a restriction, the fuel pressure regulator should be replaced.

(10) Remove the pressure gauge.

(11) Disconnect the fuel tube adaptor 6175 with disconnect tool 6182.

(12) Prior to installing the fuel tubes to the regulator and fuel rail the tube ends **MUST be lightly lubricated with clean 30 weight engine oil. Refer to Fuel Tubes and Quick-Connect Fittings in this section.**

(13) Install the black fuel supply tube to the fuel rail and the grey fuel return tube to the pressure regulator. Refer to Fuel tubes and Quick-Connect Fittings in this section for correct installation procedure.

(14) Install fuel filler cap.

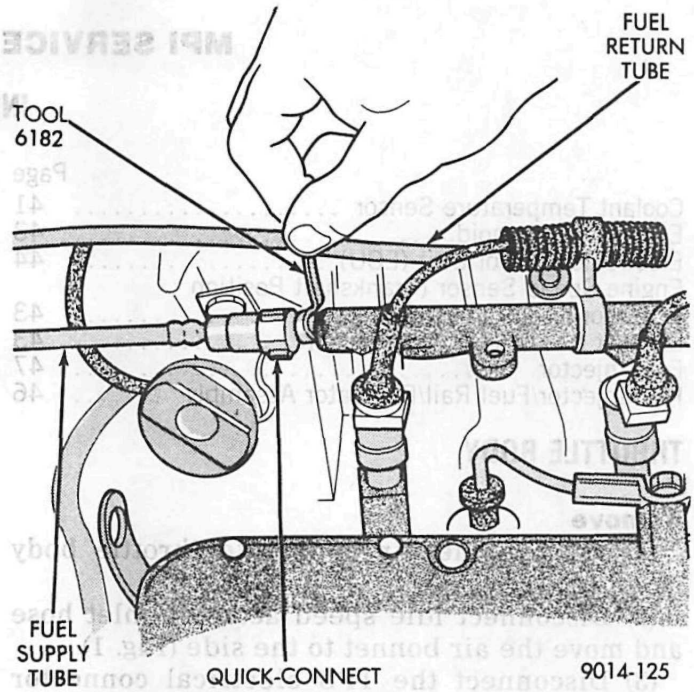


Fig. 42—Disconnecting Fuel Supply Tube at Fuel Rail—MPI

MPI SERVICE PROCEDURES

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THROTTLE BODY

Remove

(1) Remove the air bonnet to throttle body mounting screws (Fig. 1).

(2) Disconnect idle speed actuator inlet hose and move the air bonnet to the side (Fig. 1).

(3) Disconnect the TPS electrical connector (Fig. 1).

(4) Disconnect accelerator cable at throttle lever (Fig. 2).

(5) If the vehicle is equipped with cruise control, disconnect the cruise control cable at throttle lever (Fig. 2).

CAUTION: Use finger pressure only to remove the cruise control cable connector. If the connector is damaged, the complete cruise control servo and cable assembly must be replaced.

(6) Remove the throttle return spring (if applicable).

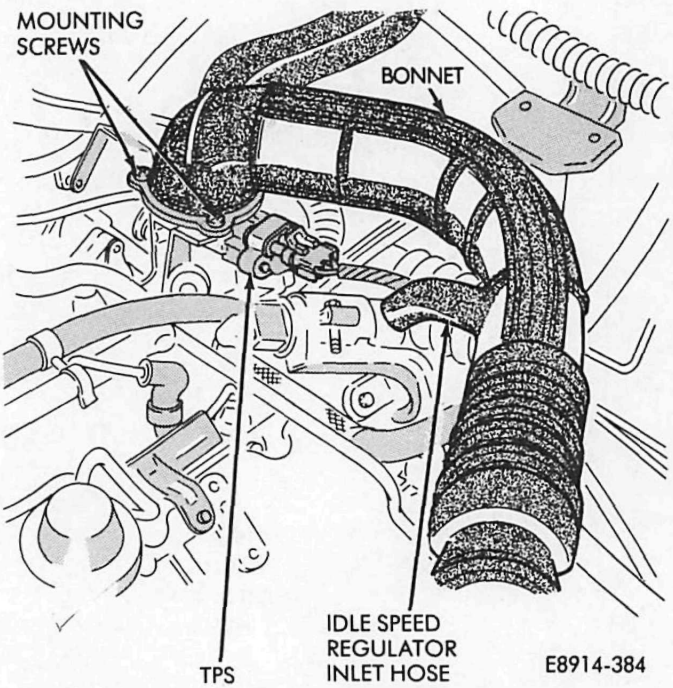


Fig. 1—Throttle Body Removal/Installation

(7) Remove throttle body mounting nuts at the base of the throttle body (Fig. 2) Remove throttle body.

(8) Remove old gasket.

CAUTION: If throttle position sensor is removed or the mounting screws are loosened, the sensor setting must be readjusted. New throttle bodies are equipped with an adjusted throttle position sensor (TPS).

Installation

(1) Install the gasket and throttle body. Tighten throttle body mounting nuts to 17.5 N·m (13 ft-lbs) torque (Fig. 2).

(2) Connect the cruise control cable (if equipped) to throttle lever.

(3) Connect accelerator cable to the throttle lever.

(4) Connect TPS electrical connector to TPS (Fig. 1).

(5) Connect idle speed regulator inlet hose.

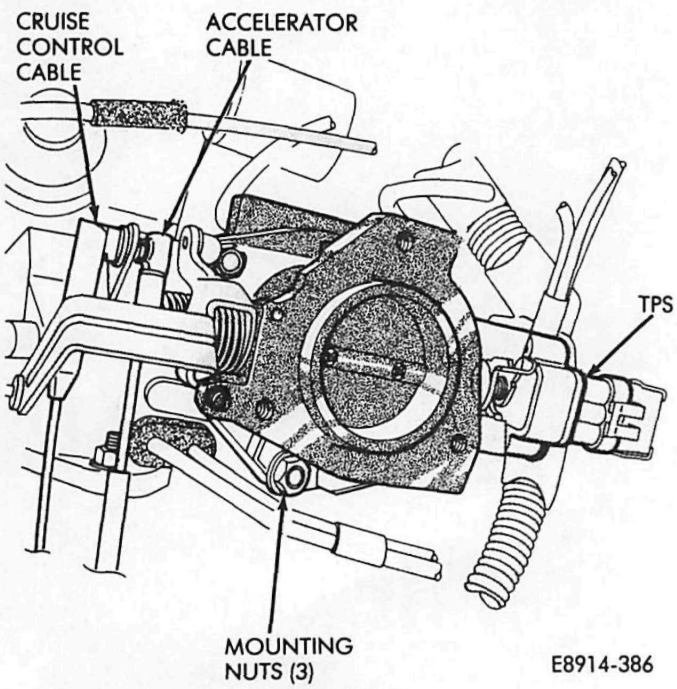


Fig. 2—Throttle Body Mounting Nuts

(6) Connect the air bonnet to the throttle body. Tighten mounting screws to 3.9 N·m (35 in-lbs) torque (Fig. 1).

(7) Connect throttle return spring (if applicable)

IDLE SPEED REGULATOR

Removal

(1) Remove regulator electrical connector (Fig. 3).

(2) Remove air inlet hose (Fig. 3).

(3) Disconnect regulator outlet hose at the regulator (Fig. 3).

(4) Remove regulator clamp bolt (Fig. 3).

(5) Remove regulator (Fig. 3).

Installation

(1) Install the regulator with the arrow (cast into the ports) pointing towards the throttle body adapter.

(2) Secure clamp with bolt (Fig. 3).

(3) Attach air inlet hose and outlet hoses to regulator.

(4) Connect electrical connector to regulator.

THROTTLE POSITION SENSOR

The Throttle Position Sensor (TPS) is attached to the throttle body (Fig. 4).

Removal

(1) Disconnect electrical connector (Fig. 4).

(2) Remove TPS mounting screws (Fig. 4).

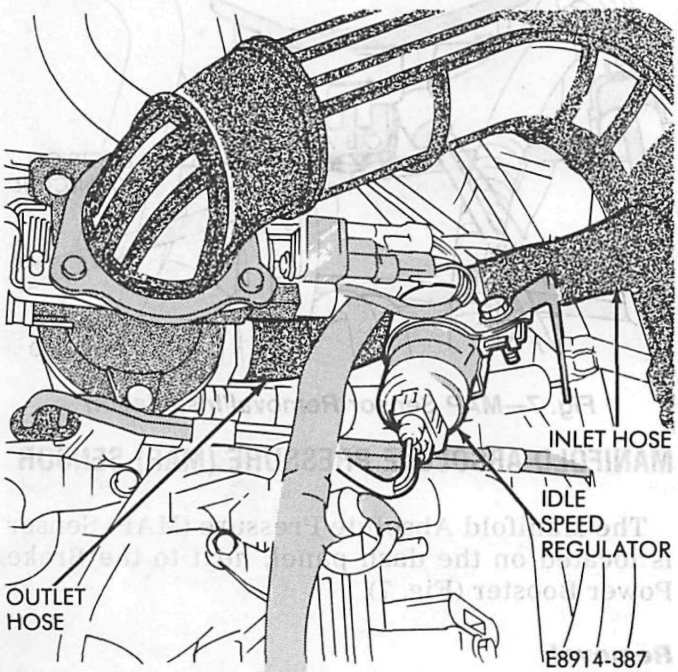


Fig. 3—Idle Speed Regulator Removal/Installation

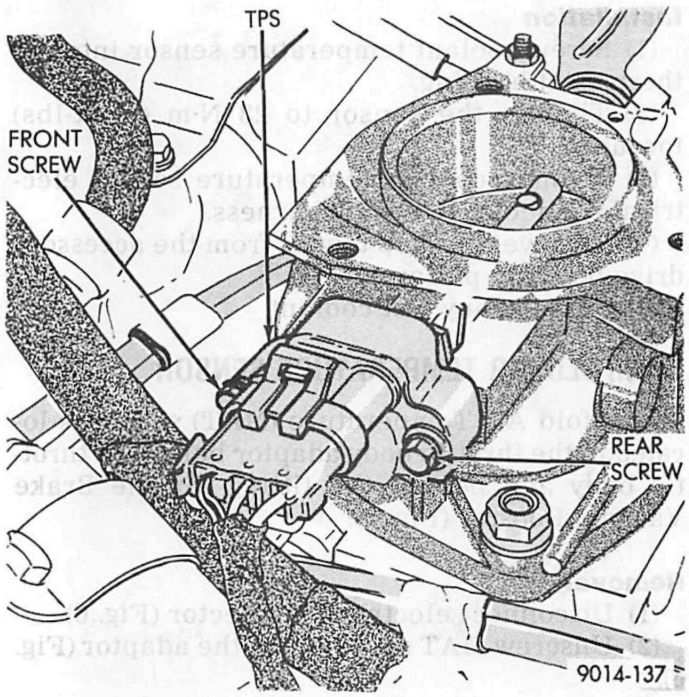


Fig. 4—Throttle Position Sensor Removal/Installation

(3) Remove the wire harness mounting bracket screws.

(4) Remove TPS (Fig. 4).

Installation

(1) Install TPS wire harness mounting bracket screws.

When installing the TPS, ensure that the TPS lever is on top of the throttle lever.

(2) Install TPS (Fig. 4).

(3) Connect electrical connector.

(4) Adjust TPS. Refer to TPS adjustment in the MPI Service Adjustments section of this group.

(5) Tighten TPS mounting screws (Fig. 4).

COOLANT TEMPERATURE SENSOR

Removal

The coolant temperature sensor is located in the thermostat housing, above the water pump (Fig. 5).

CAUTION: It is essential that coolant does not contact the accessory drive belt or pulleys because it may cause the belt to slip and/or squeak. Cover the belt and pulleys with shop towels to protect them from coolant spillage. If coolant contacts the belt or pulleys, flush them with clean water.

(1) Disconnect electrical connector.

(2) Remove coolant temperature sensor and immediately plug the opening in the water pump (Fig. 5).

Installation

(1) Screw coolant temperature sensor into the thermostat housing.

(2) Tighten the sensor to 28 N·m (21 ft-lbs) torque.

(3) Connect coolant temperature sensor electrical connector to wiring harness.

(4) Remove the shop towels from the accessory drive belt and pulleys.

(5) Replace any lost coolant.

MANIFOLD AIR TEMPERATURE SENSOR

Manifold Air Temperature (MAT) sensor is located in the throttle body adaptor below the throttle body and behind the fitting for the Brake Vacuum Booster (Fig. 6).

Removal

(1) Disconnect electrical connector (Fig. 6).

(2) Unscrew MAT sensor from the adaptor (Fig. 6).

Installation

(1) Install MAT sensor in throttle body adapter (Fig. 6).

(2) Tighten the MAT sensor to 28 N·m (21 ft-lbs) torque.

(3) Connect MAT sensor electrical connector to wiring harness.

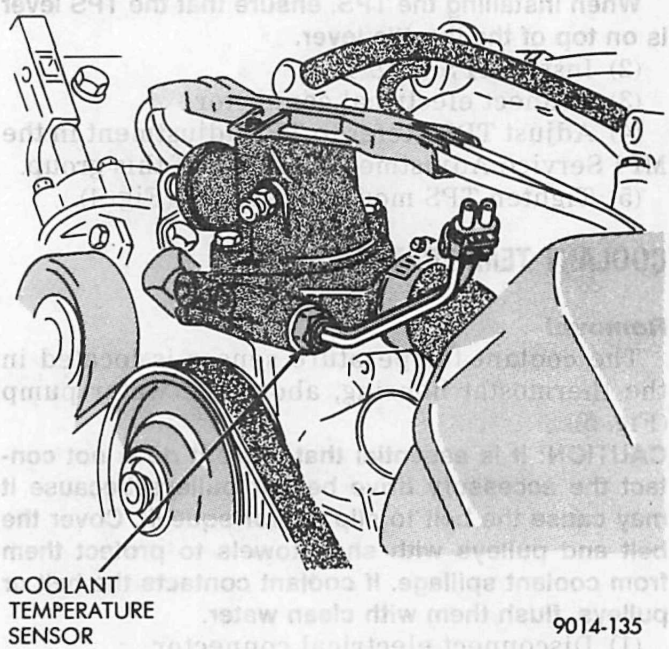


Fig. 5—Coolant Temperature Sensor Removal/Installation

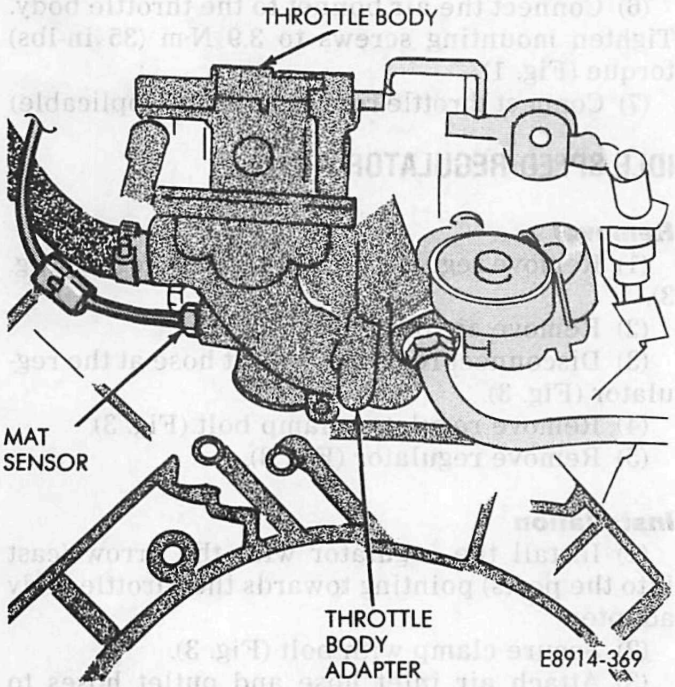


Fig. 6—MAT Sensor Removal/Installation

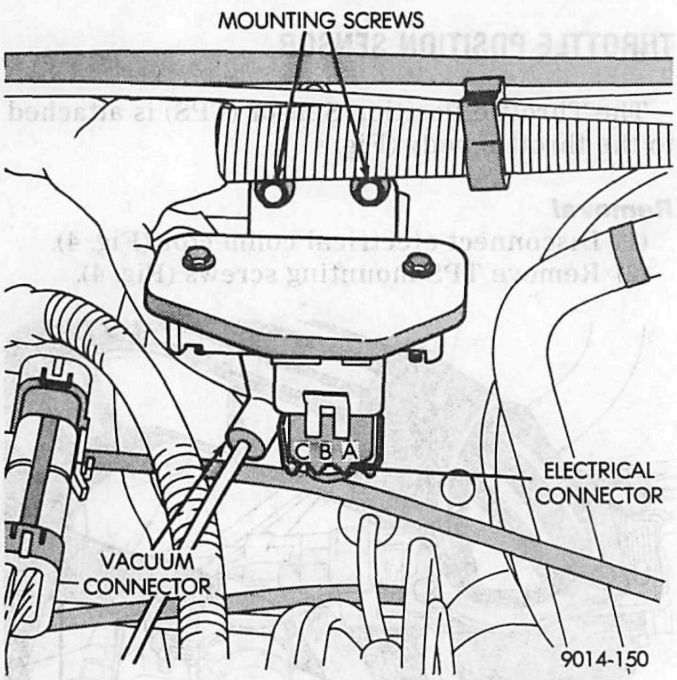


Fig. 7—MAP Sensor Removal/Installation

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

The Manifold Absolute Pressure (MAP) Sensor is located on the dash panel, next to the Brake Power Booster (Fig. 7).

Removal

(1) Disconnect electrical connector from MAP sensor (Fig. 7).

(2) Disconnect vacuum hose from MAP sensor.
(3) Remove MAP sensor mounting screws.
(4) Remove MAP sensor.

Installation

(1) Install MAP sensor on the dash panel with mounting screws. Tighten the mounting screws.
(2) Connect vacuum hose to MAP sensor.
(3) Connect electrical connector to MAP sensor.

EXHAUST GAS OXYGEN (O_2) SENSOR

The exhaust gas oxygen (O_2) sensor is located in the exhaust "Y" pipe before the catalytic convertor (Fig. 8).

Removal

(1) Raise the car on a hoist.
(2) Disconnect electrical connector from O_2 sensor (Fig. 8).
(3) Unscrew O_2 oxygen sensor from the Y-pipe.
(4) Clean the threads in the Y-pipe.

Installation

The threads of new O_2 sensors are coated with an anti-seize compound to aid in installation and removal.
(1) Thread oxygen O_2 sensor into the Y-pipe.
(2) Tighten the sensor to 30 N·m (22 ft.-lbs.) torque.
(3) Connect electrical connector to O_2 sensor.
(4) Lower the car.

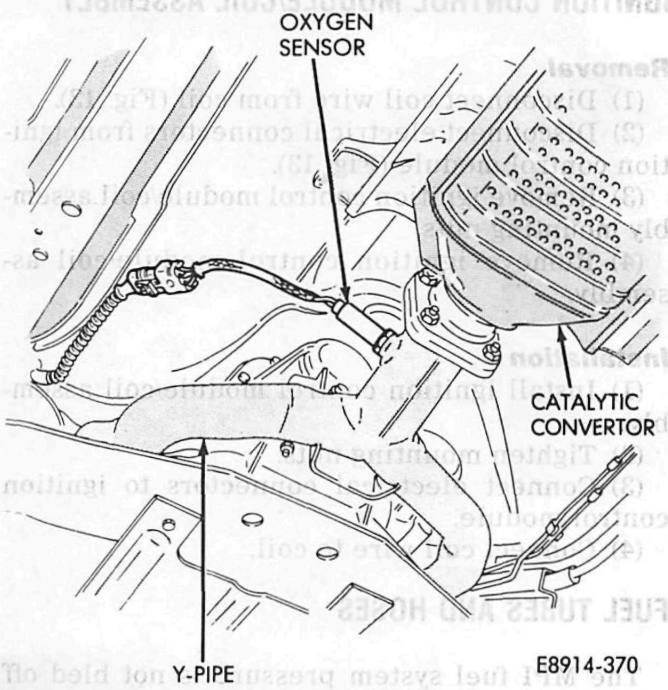


Fig. 8—O_2 Sensor Removal/Installation

ENGINE SPEED SENSOR (CRANKSHAFT POSITION SENSOR—CPS)

The Speed Sensor is located on the left side of the transmission converter housing behind the rear face of the engine (Fig. 9).

Removal

(1) Remove the speed sensor mounting screws (Fig. 9).
(2) Disconnect speed sensor wire connector.
(3) Remove speed sensor.

Installation

(1) Install speed sensor (Fig. 9).
(2) Tighten mounting screws to 8 N·m (71 in-lbs) torque.
(3) Connect wire connector to speed sensor.

EGR VALVE SOLENOID

The Exhaust Gas Recirculation (EGR) Solenoid is located on the drivers side on the fender panel of the engine compartment (Fig. 10).

Removal

(1) Disconnect vacuum lines at solenoid (Fig. 10).
(2) Remove solenoid mounting screw.
(3) Remove solenoid.

Installation

(1) Install solenoid and tighten mounting screw (Fig. 10).

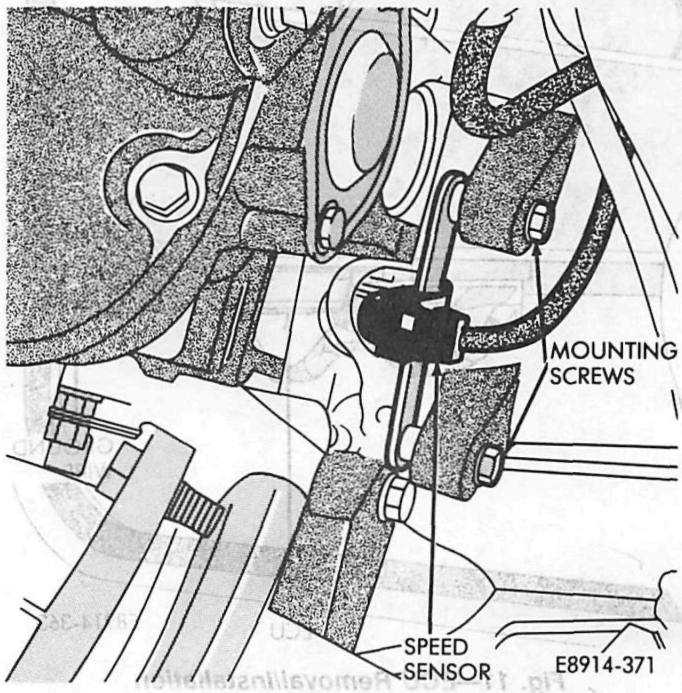


Fig. 9—Engine Speed Sensor Removal/Installation

(2) Connect electrical connector to solenoid.
(3) Connect vacuum lines to solenoid.

ELECTRONIC CONTROL UNIT (ECU)

The ECU is located under the instrument panel on the passenger side of the vehicle (Fig. 11).

Removal

(1) Raise the hood and disconnect the battery negative cable.
(2) Remove the ECU mounting nuts and ground strap, remove the ECU from the vehicle (Fig. 11).
(3) Disconnect the harness connectors from the ECU (Fig. 12).

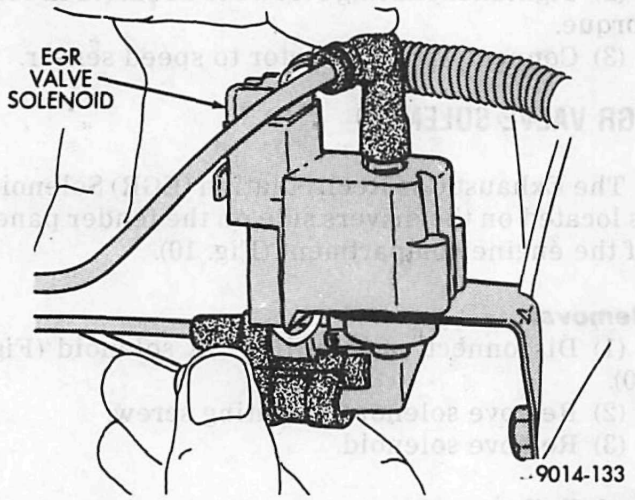


Fig. 10—EGR Valve Solenoid Removal/Installation

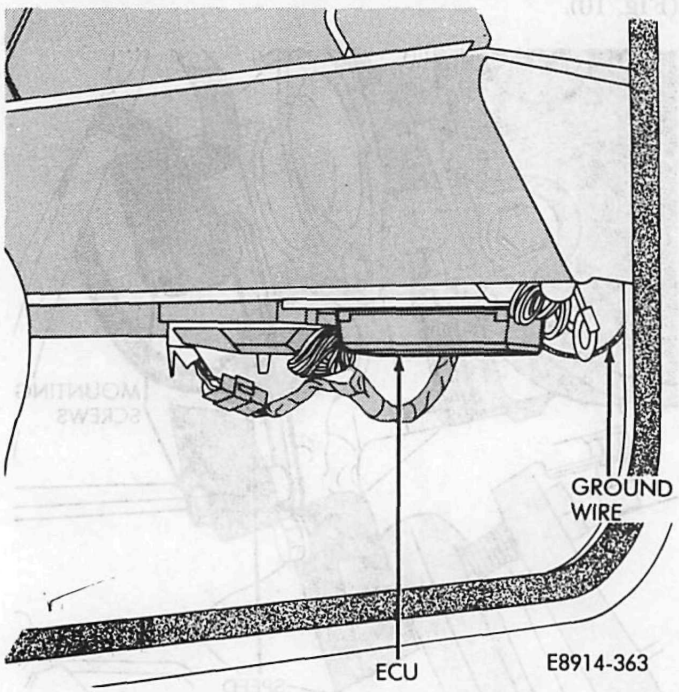


Fig. 11—ECU Removal/Installation

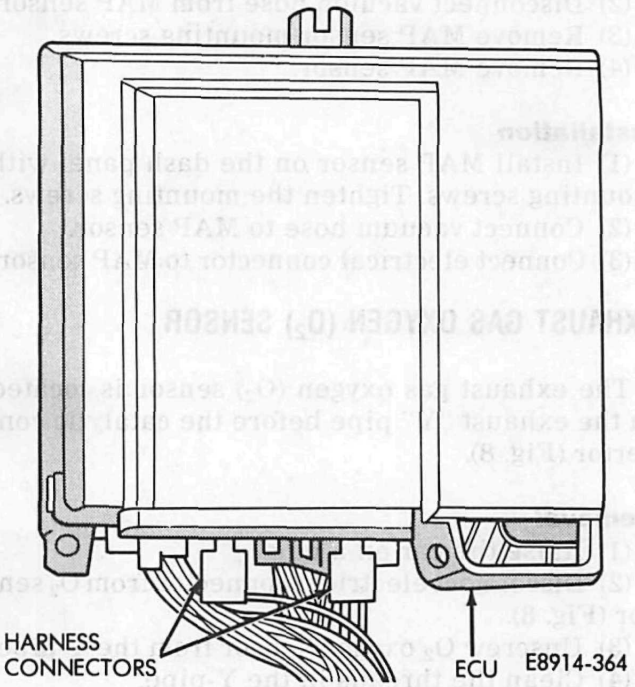


Fig. 12—ECU Connectors

Installation

(1) Connect harness connectors to the ECU.
(2) Push the ECU over the positioning studs.
(3) Install the ground strap and tighten the mounting nuts.
(4) Connect the battery negative cable.
(5) Close the hood.

IGNITION CONTROL MODULE/COIL ASSEMBLY

Removal

(1) Disconnect coil wire from coil (Fig. 13).
(2) Disconnect electrical connectors from ignition control module (Fig. 13).
(3) Remove ignition control module/coil assembly mounting nuts.
(4) Remove ignition control module/coil assembly.

Installation

(1) Install ignition control module/coil assembly.
(2) Tighten mounting nuts.
(3) Connect electrical connectors to ignition control module.
(4) Connect coil wire to coil.

FUEL TUBES AND HOSES

The MPI fuel system pressure is not bled off when the fuel pump stops operating. Fuel spray will result when disconnecting fuel system hoses and tubes. Wrap shop towels around tubes and

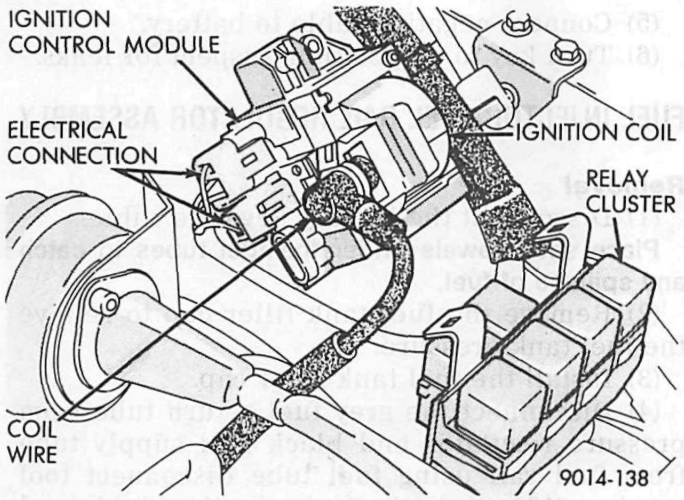


Fig. 13—Ignition Control Module/Coil Assembly

hoses to absorb fuel spray before disconnecting them. When removing fuel system hoses and tubes use care to avoid damaging the hoses or tube ends.

Fuel Tubes

This vehicle utilizes plastic fuel tubes with quick-connect fittings. The fuel tubes are connected to fuel system components by integral quick-connect fittings.

CAUTION: If a quick-connect fitting is damaged, do not attempt to remove the fitting from the fuel tube to replace it, the complete fuel tube and quick-connect fitting must be replaced as an assembly.

WARNING: KEEP OPEN FLAME SUCH AS CUTTING TORCHES AWAY FROM THE FUEL TUBES AND FUEL TANK WHEN SERVICING THE VEHICLE AND EXTINGUISH ALL TOBACCO SMOKING MATERIALS.

Quick Connect Fittings

The fuel system used on this vehicle utilizes plastic fuel tubes with quick-connect fittings that have sealed O-ring seals. The O-rings of the quick-connect fittings do not have to be replaced when the fittings are disconnected.

The quick-connect fitting consists of the O-rings, retainer and casing (Fig. 14). When the fuel tube nipple is inserted into the quick-connect fitting, the shoulder of the nipple is locked in place by the retainer, and the O-rings seal the tube.

The fuel tube nipples must be lubricated with clean 30 weight engine oil prior to reconnecting the quick-connect fitting. **No other lubricant may be used.**

When the fittings are disconnected the retainer will stay on the nipple of the component that the tube is being disconnected from. Either remove the retainer from the nipple and reinstall it in the quick connect fitting prior to reconnecting the fitting, or leave the retainer on the nipple and push the fitting over the nipple and retainer when reconnecting the fitting. In either case, care must be taken to ensure that the retainer is locked securely into the quick-connect fitting.

If the quick-connect fitting has "windows" in the sides of the casing, the retainer locking "ears" and the shoulder (stop bead) on the fuel tube must be visible in the windows or the retainer is not properly installed (Fig. 15). After connecting a quick-connect fitting, the connection should be verified by pulling on the lines to ensure that the lock is secure.

Fuel tube disconnect tool 6182 can be used at the 3.0L engine fuel rail and fuel pressure regulator to remove the quick-connect fitting and retainer as an assembly (Fig. 16). The retainer will remain in the fitting in the correct position. To install the fuel tube, push it over the nipple until a click is heard. Pull back on the tube to ensure that the connector is locked in place.

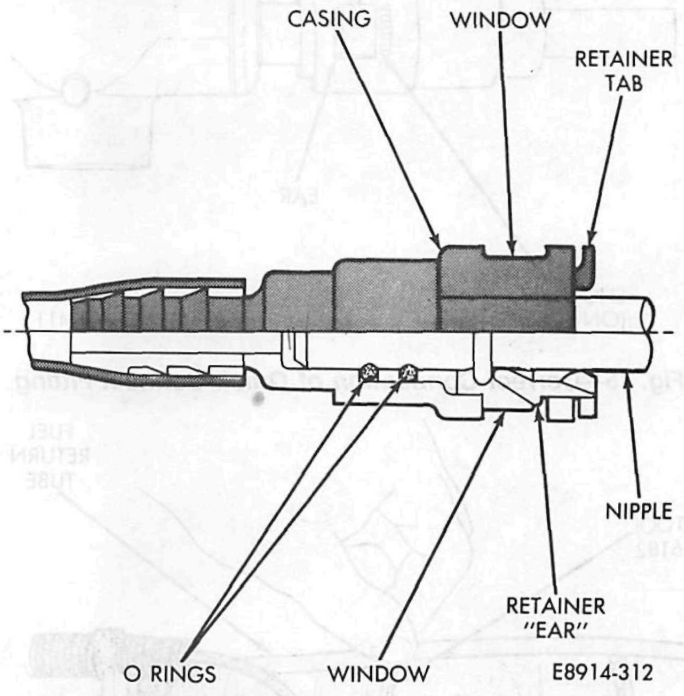


Fig. 14—Quick-Connect Fitting

Tube/Fitting Disassembly

(1) Disconnect battery negative cable from battery.

WARNING: FUEL SYSTEM PRESSURE WILL BE RELEASED WHEN THE QUICK-CONNECT FITTING IS DISCONNECTED. PLACE SHOP TOWELS AROUND TUBE TO ABSORB SPILLED FUEL. WEAR EYE PROTECTION AND EXTINGUISH ALL SMOKING DEVICES.

(2) Squeeze retainer tabs together and pull quick-connect fitting apart (Fig. 14). Note that retainer tabs stay on the nipple.

Tube/Fitting Assembly

(1) Using a clean lint free cloth, wipe clean the tube end (nipple) and retainer.

(2) Apply a light film of clean 30 weight engine oil to the tube end. **DO NOT use any other lubricant.**

(3) Push the quick-connect fitting over the fuel tube until the retainer seats and a click is heard.

(4) If the quick-connect fitting is the type that has "windows" on the side, ensure that the locking "ears" on the retainer and the shoulder (stop bead) on the fuel tube are completely visible in the "windows." Do not rely upon the audible click to confirm that a secure connection has been made. Pull back on the quick-connect fitting to further ensure that the connection is complete and the connector is locked in place.

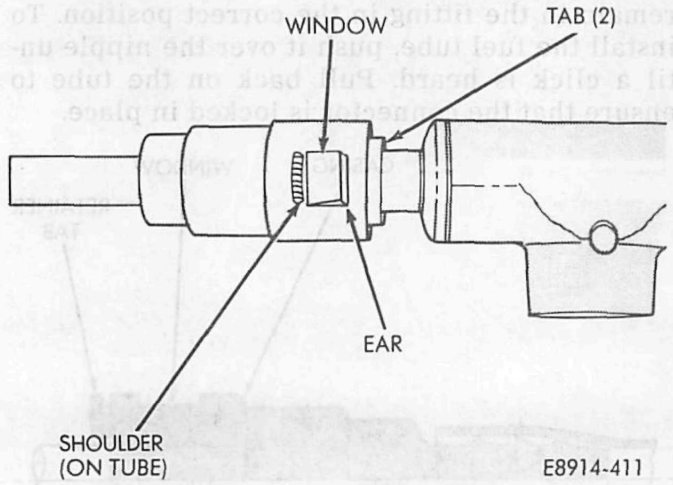


Fig. 15—Correct Connection of Quick-Connect Fitting

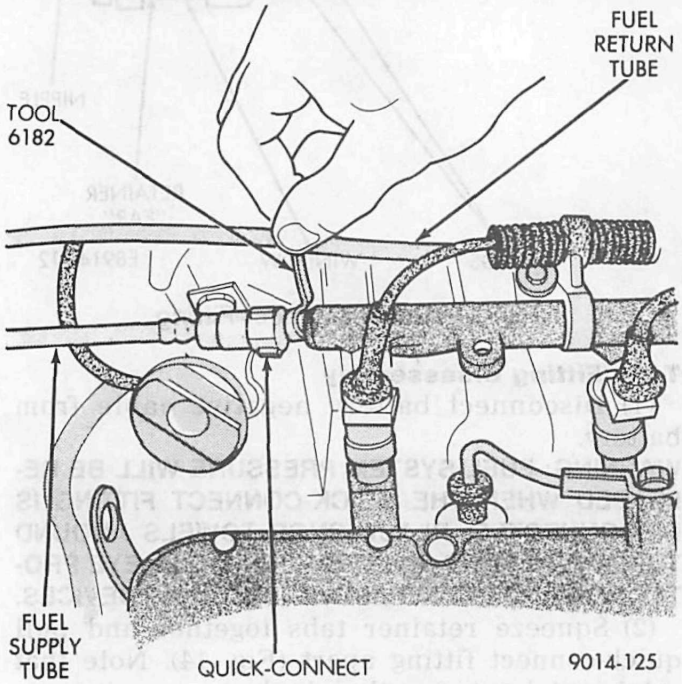


Fig. 16—Fuel Tube to Fuel Rail Quick-Disconnect Tool—3.0L Engine

(5) Connect negative cable to battery.

(6) Turn key to on position. Inspect for leaks.

FUEL INJECTOR/FUEL RAIL/REGULATOR ASSEMBLY

Removal

(1) Disconnect the battery negative cable.

Place shop towels under the fuel tubes to catch any spillage of fuel.

(2) Remove the fuel tank filler cap to relieve the fuel tank pressure.

(3) Install the fuel tank filler cap.

(4) Disconnect the grey fuel return tube from pressure regulator and black fuel supply tube from fuel rail using fuel tube disconnect tool number 6182. Slide the tool onto the nipple and push it forward into quick-connector until the handle stops on the connector casing. Pull the fuel tubes off (Fig. 17).

WARNING: FUEL SYSTEM PRESSURE WILL BE RELEASED WHEN THE QUICK-CONNECT FITTING IS DISCONNECTED. PLACE SHOP TOWELS AROUND TUBE TO ABSORB SPILLED FUEL. WEAR EYE PROTECTION AND EXTINGUISH ALL SMOKING DEVICES.

(5) Mark the injector electrical connector with the number of the corresponding injector for installation reference.

(6) Disconnect the electrical connector from the injectors. Remove the injector wire harness and lay to the side.

(7) Disconnect the accelerator cable from the throttle body and holding bracket.

(8) If equipped, disconnect the cruise control cable from the throttle body and holding bracket.

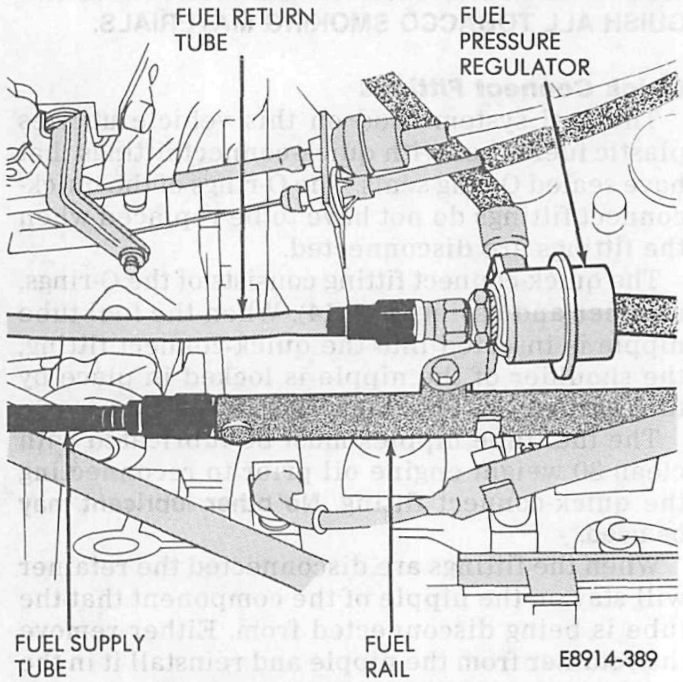


Fig. 17—Fuel Rail Removal/Installation

CAUTION: Use finger pressure only to remove the cruise control cable connector. If the connector is damaged, the complete cruise control servo and cable assembly must be replaced.

(9) Remove fuel rail mounting screws. Remove the fuel pressure regulator mounting screws (Fig. 18).

(10) Disconnect vacuum hose from fuel pressure regulator.

(11) Pull the fuel rails, regulator and injector assembly up until the injectors are out of the openings in the intake manifold.

(12) Pull the assembly out from under the throttle cable.

Installation

(1) Lubricate the injector O-rings with a drop of clean engine oil.

(2) Position the assembly so that the injectors are above the openings in the intake manifold.

(3) Push the injectors into the openings. Be sure not to damage the injector O-rings.

(4) Install fuel rail and regulator hold down bolts (Fig. 18).

(5) Connect the acceleration and cruise control cables to the throttle body.

(6) Connect the fuel injector electrical connectors in the correct order.

(7) Refer to Fuel Tubes and Quick-Connect Fittings in this group for quick-connect fitting connection procedures and connect the black fuel supply tube to the fuel rail and the grey fuel return tube to the fuel pressure regulator accordingly.

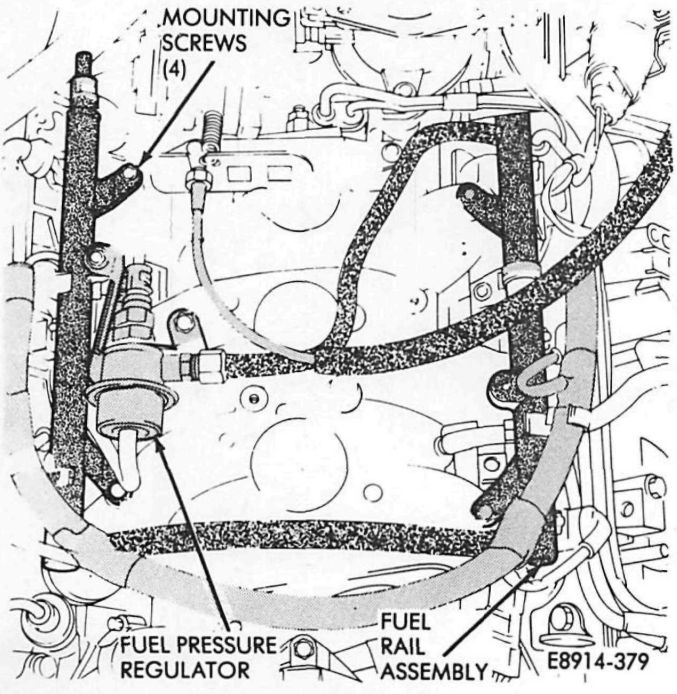


Fig. 18—Fuel Rail and Regulator Mounting Screws

(8) Connect vacuum hose to fuel pressure regulator.

(9) Connect the battery negative cable.

(10) Turn the key to the ON position to pressurize the fuel system and check for leaks.

FUEL INJECTOR

Removal

(1) Remove the fuel injector, fuel rail and regulator assembly. Refer to Fuel Injector/Fuel Rail/Regulator Assembly in this section.

(2) Remove clip holding fuel injector to fuel rail.

(3) Pull the injector out of the fuel rail (Fig. 19).

Installation

(1) Lubricate the injector O-ring with a drop of clean engine oil.

(2) Install fuel injector into fuel rail.

(3) Connect clip (Fig. 19).

(4) Install the fuel injector, fuel rail and regulator assembly. Refer to Fuel Injector/Fuel Rail/Regulator Assembly in this section.

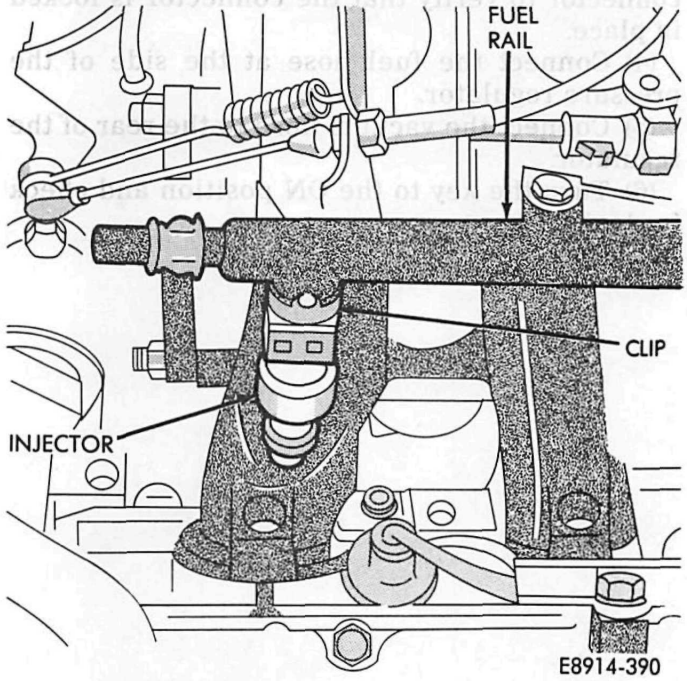


Fig. 19—Fuel Injector Removal/Installation

FUEL PRESSURE REGULATOR

CAUTION: When disconnecting the fuel return tube from the fuel pressure regulator, wrap shop towels around the quick-connect fitting to catch any fuel spillage that occurs when disconnecting the tube. Do not disconnect the fuel tubes on a hot engine.

Removal

(1) Disconnect fuel return tube from fuel pressure regulator using tool 6182 (Fig. 16). Slide the tool over the nipple and push the tool into the connector until it stops on the casing. Slowly pull the connector away.

(2) Disconnect vacuum hose from pressure regulator (Fig. 20).

(3) Unscrew line nut from the fitting at the side of the fuel pressure regulator (Fig. 20).

(4) Remove nipple fitting at the return side of the regulator.

(5) Remove locknut and washer. Remove the regulator.

Installation

(1) Install the fuel pressure regulator, washer, and locknut. Tighten the locknut.

(2) Refer to Fuel Tubes and Quick-Connect Fittings in this group for quick-connect fitting connection procedures and install the nipple fitting on the pressure regulator accordingly.

(3) Connect the fuel return line to the fuel pressure regulator. Push the connector over the nipple until a click is heard. Pull back on the connector to verify that the connector is locked in place.

(4) Connect the fuel hose at the side of the pressure regulator.

(5) Connect the vacuum hose to the rear of the regulator.

(6) Turn the key to the ON position and check for leaks.

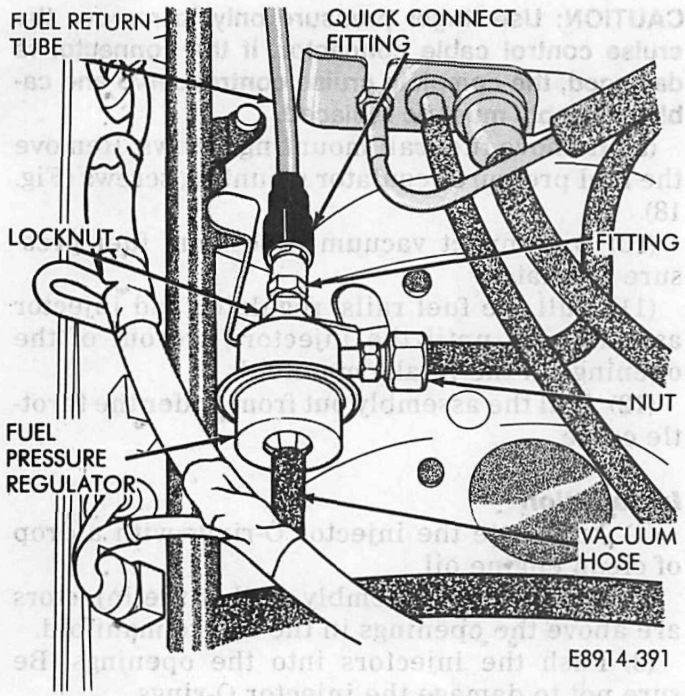


Fig. 20—MPI Fuel Pressure Regulator Removal/Installation

MPI SERVICE ADJUSTMENTS

THROTTLE POSITION SENSOR (TPS) ADJUSTMENT

Automatic Transmission

This throttle position sensor adjustment uses a high impedance digital voltmeter (such as C4845 or an equivalent). This adjustment can also be performed on the DRB II tester and is the preferred method. Refer to the tester manual.

(1) Turn the ignition key to the ON position.

(2) Do not unfasten the TPS wire harness connector (Fig. 21). Insert the voltmeter test leads through the back of the wire harness connector.

The TPS connector terminals are marked A, B, C.

(3) Check the TPS input voltage at the harness connector. Locate terminal B and insert the negative lead of the voltmeter into it. Insert the positive lead of the voltmeter to TPS terminal C.

(4) Note the sensor input voltage on the voltmeter (at terminal B and C).

(5) Check the TPS output voltage. Disconnect the voltmeter positive lead from sensor terminal C and connect it to sensor terminal A.

(6) Note the sensor output voltage on the voltmeter (at terminals B and A).

(7) Divide the output voltage by the input voltage. The resulting output ratio should be .075 to .085 (7.5 to 8.5).

EXAMPLE: If the input voltage is 5 volts and the output voltage is .4 volts; divide .4 by 5 (.4/5 = .08 or 8).

(8) If necessary, adjust the TPS sensor until the correct ratio is obtained. To adjust the voltage readings, loosen the sensor rear retaining screw and pivot the sensor for a fine adjustment. Loosen the sensor front retaining screw and pivot the sensor for a course adjustment (Fig. 21).

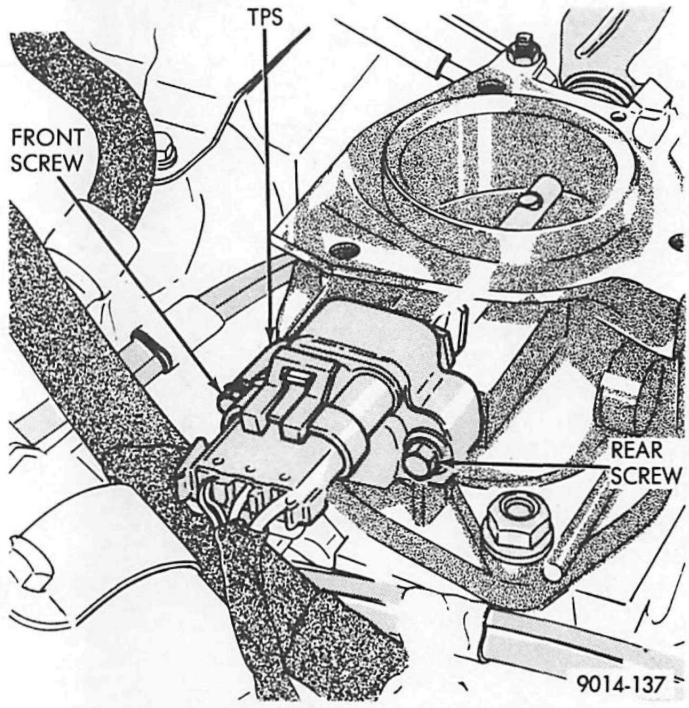


Fig. 21—TPS Adjustment

POWER STEERING SYSTEM

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Power Steering Pump Service	8
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GENERAL SERVICE PROCEDURES

Service Information

Pumps

Vehicles equipped with a 3.0L V-6 engine have an N-series type pump (Fig. 1) Remote (non-integral) fluid reservoir is used.

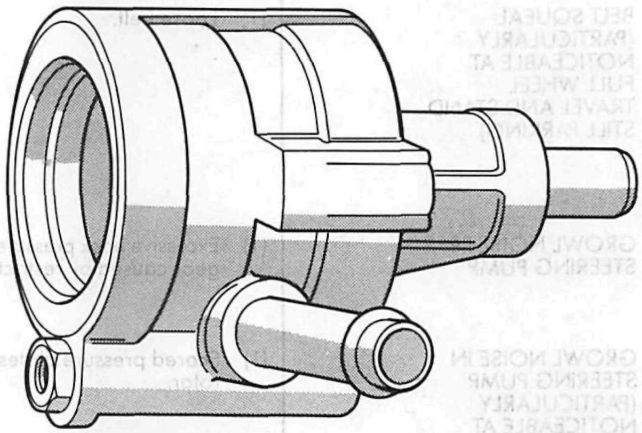
Fluid Reservoirs

For vehicles equipped with a 3.0L V-6 engine, the reservoir (Fig. 2) is located near the front of the left (driver side) cylinder head. Hoses are used to connect the remote fluid reservoir to the pump.

The correct fluid level is indicated at the full mark on the dipstick (Fig. 2). Use MOPAR Power Steering Fluid or an equivalent fluid.

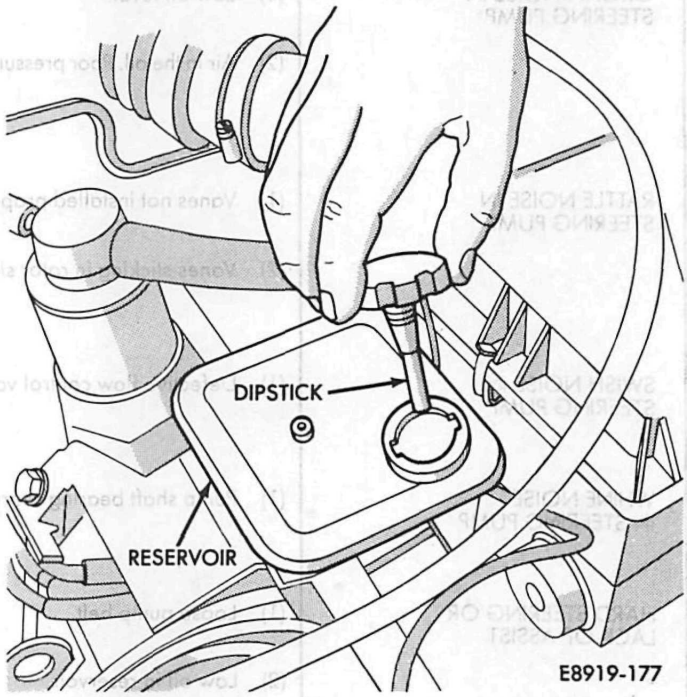
Service Diagnosis

The power steering Service Diagnosis charts are provided (below) to assist in correcting system malfunctions. The diagnosis charts provide a list of the most common causes for unusual noises, low pressure, and erratic/inconsistent system operation.



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Fig. 1—N-Series Pump (3.0L V-6 Engine)



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Fig. 2—3.0L V-6 Engine Remote Fluid Reservoir

CONDITION	POSSIBLE CAUSE	CORRECTION
CHIRP NOISE IN STEERING PUMP	(1) Loose belt.	(1) Adjust belt tension to specification.
BELT SQUEAL (PARTICULARLY NOTICEABLE AT FULL WHEEL TRAVEL AND STAND STILL PARKING)	(1) Loose belt.	(1) Adjust belt tension to specification.
GROWL NOISE IN STEERING PUMP	(1) Excessive back pressure in hoses or steering gear caused by restriction.	(1) Locate restriction and correct. Replace part if necessary.
GROWL NOISE IN STEERING PUMP (PARTICULARLY NOTICEABLE AT STAND STILL PARKING	(1) Scored pressure plates, thrust plate or rotor. (2) Extreme wear of cam ring.	(1) Replace parts and flush system. (2) Replace parts.
GROAN NOISE IN STEERING PUMP	(1) Low oil level. (2) Air in the oil. Poor pressure hose connection.	(1) Fill reservoir to proper level. (2) Tighten connector to specified torque. Bleed system by operating steering from right to left - full turn.
RATTLE NOISE IN STEERING PUMP	(1) Vanes not installed properly. (2) Vanes sticking in rotor slots.	(1) Install properly. (2) Free up by removing burrs, varnish, or dirt.
SWISH NOISE IN STEERING PUMP	(1) Defective flow control valve.	(1) Replace part.
WHINE NOISE IN STEERING PUMP	(1) Pump shaft bearing scored.	(1) Replace housing and shaft. Flush system.
HARD STEERING OR LACK OF ASSIST	(1) Loose pump belt. (2) Low oil in reservoir. **NOTE:** Low oil level will also result in excessive pump noise. (3) Steering gear to column misalignment. (4) Lower coupling flange rubbing against steering gear adjuster. (5) Tires not properly inflated.	(1) Adjust belt tension to specification. (2) Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage. Tighten loose connectors. (3) Align steering column. (4) Loosen pinch bolt and assemble properly. (5) Inflate to recommended pressure.

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CONDITION	POSSIBLE CAUSE	CORRECTION
	Further possible causes could be:	
	(6) Sticking flow control valve.	In order to diagnose conditions such as listed in (6), (7), (8), (9) a pressure test of the entire power steering system is required.
	(7) Insufficient pump pressure output.	
	(8) Excessive internal pump leakage.	
	(9) Excessive internal gear leakage.	
FOAMING MILKY POWER STEERING FLUID, LOW FLUID LEVEL AND POSSIBLE LOW PRESSURE	(1) Air in the fluid, and loss of fluid due to internal pump leakage causing overflow.	(1) Check for leaks and correct. Bleed system. Extremely cold temperatures will cause system aeriation should the oil level be low. If oil level is correct and pump still foams, remove pump from vehicle and separate reservoir from body. Check welsh plug and body for cracks. If plug is loose or body is cracked, replace body.
LOW PUMP PRESSURE	(1) Flow control valve stuck or inoperative.	(1) Remove burrs or dirt or replace. Flush system.
	(2) Pressure plate not flat against cam ring.	(2) Correct.
MOMENTARY INCREASE IN EFFORT WHEN TURNING WHEEL FAST TO RIGHT OR LEFT	(1) Low oil level in pump.	(1) Add power steering fluid as required.
	(2) Pump belt slipping.	(2) Tighten or replace belt.
	(3) High internal leakage.	(3) Check pump pressure. (See pressure test.)
STEERING WHEEL SURGES OR JERKS WHEN TURNING WITH ENGINE RUNNING ESPECIALLY DURING PARKING	(1) Low oil level.	(1) Fill as required.
	(2) Loose pump belt.	(2) Adjust tension to specification.
	(3) Steering linkage hitting engine oil pan at full turn.	(3) Correct clearance.
	(4) Insufficient pump pressure.	(4) Check pump pressure. (See pressure test.) Replace flow control valve if defective.
	(5) Sticking flow control valve.	(5) Inspect for varnish or damage, replace if necessary.
EXCESSIVE WHEEL KICKBACK OR LOOSE STEERING	(1) Air in system.	(1) Add oil to pump reservoir and bleed by operating steering. Check hose connectors for proper torque and adjust as required.

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CONDITION	POSSIBLE CAUSE	CORRECTION
LOW PUMP PRESSURE	(1) Flow control valve stuck or inoperative.	(1) Remove burrs or dirt. Replace valve if damaged.
	(2) Pump pressure plate not seating (flat) against cam ring.	(2) Disassemble pump and correct.
	(3) Extreme wear of cam ring.	(3) Replace parts. Flush system.
	(4) Scored pressure plate, thrust plate, or rotor.	(4) Replace parts. Flush system.
	(5) Vanes not installed properly.	(5) Install properly.
	(6) Vanes sticking in rotor slots.	(6) Freeup by removing burrs, varnish, or dirt.
	(7) Cracked or broken thrust or pressure plate.	(7) Replace part.
		J8919-70

Pressure Test

(1) Test and adjust, if necessary, the power steering pump belt tension. If necessary, refer to the applicable procedure listed in Drive Belt Adjustment in Group 7, Cooling for detailed instructions.

(2) Place a drip pan under the engine and disconnect the power steering pump high pressure hose either at the pump (3.0L V-6 engines). Maintain the hose end raised above the reservoir to prevent fluid loss.

(3) Connect one side of a pressure test gauge to the pump high pressure hose with an adapter hose (use an additional adapter hose if necessary). Connect the other side of the pressure test gauge to the power steering pump with an adapter hose (Fig. 3).

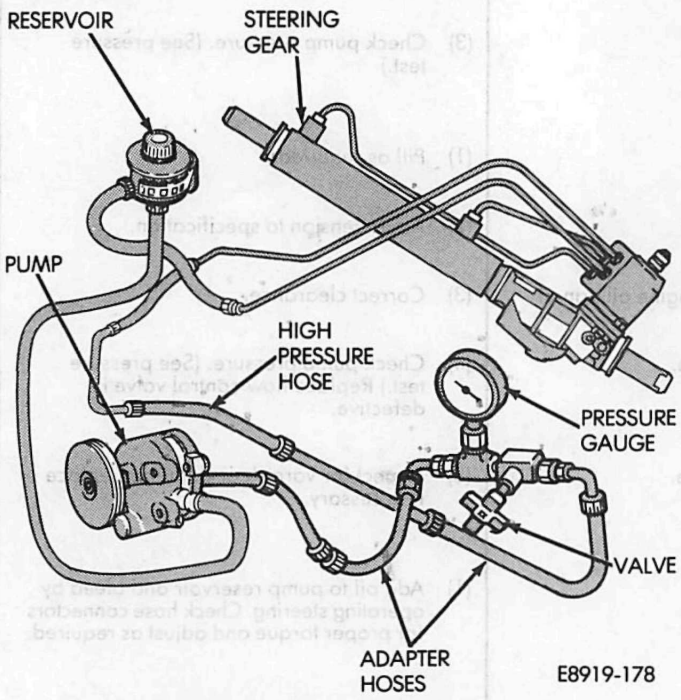


Fig. 3—Pressure Testing

CAUTION: Ensure that the test gauge is connected in the fluid high pressure circuit between the pump and the steering gear.

(4) Open the test valve completely. Rotate the valve counterclockwise to open it (Fig. 3).

(5) Fill the fluid reservoir with power steering fluid as necessary.

(6) Start and operate the engine until the power steering fluid reaches the normal operating temperature of approximately 77°C (170°F).

(7) Observe the pressure test gauge, the pressure should be less than 1030 kPa (150 psi). If the pressure is 1030 kPa (150 psi) or more, inspect the hoses for restrictions and repair as necessary.

CAUTION: The following test involves testing the maximum pump pressure output and the flow control valve operation. Do not close the test gauge valve for more than 5 seconds at a time because this could damage the pump.

(8) Close the pressure test gauge valve completely for 2 to 4 seconds, then immediately open it (Fig. 3). Repeat this operation three times and record the highest pressure indicated on the pressure test gauge each time the valve is closed.

(9) Compare the highest indicated pressures. If the pressure indications are within the range specified, and the variance of the three pressure indications is within the 345 kPa (50 psi) allowable variance, the pump is functioning normally.

For example: if the highest indicated pressures for a vehicle equipped with a 3.0L V-6 engine are 7929 kPa, 7998 kPa and 8067 kPa (1150 psi, 1160 psi and 1170 psi), they are acceptable and the pressure variance is within the 345 kPa (50 psi) allowable variance. The pump operation is normal.

(10) If the highest indicated pressures are more than the acceptable limit for the vehicle and the pressures are not within the 345 kPa (50 psi) allowable variance, the flow control valve is not

functioning correctly. Remove and clean the valve (Fig. 6). Remove burrs with a crocus cloth or a fine grit hone. If the system is contaminated, flush it.

CAUTION: Do not force the pump to operate against the steering stops for more than 2 to 4 seconds at a time because, otherwise, pump damage will result.

(11) If the pump operation is acceptable, continue with the test. With the gauge valve open, turn the steering wheel to the extreme left and right positions to force the pump to operate against the steering stops (Fig. 5). Record the highest indicated pressure at each steering wheel extreme position.

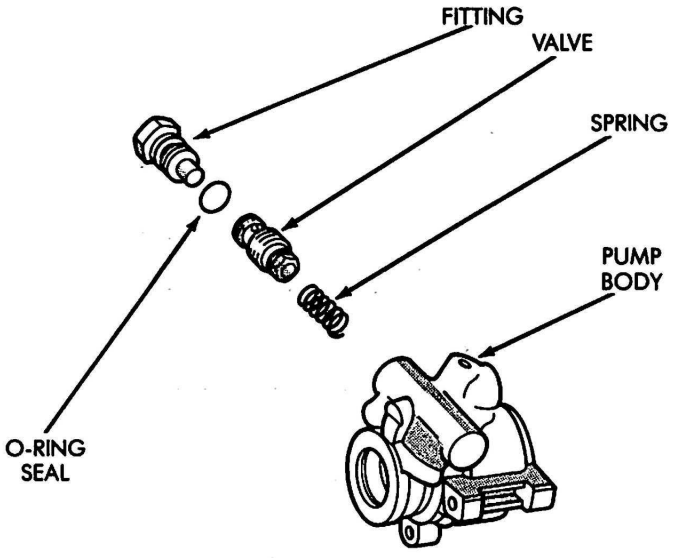
(12) Compare the extreme left and the right turn pressures with the previously noted pump highest output pressures. If the pump highest output pressures are not duplicated when the pump is forced to operate against either steering stop, the steering gear is leaking internally and must be replaced.

(13) Stop the engine and remove the test equipment. Connect the pressure hose.

(14) Repair the system as necessary and correct the fluid level. Remove the drip pan.

Fluid Leaks—Detection

In addition to the following procedure, a black light detection device can be used to locate power steering fluid leaks. The dye is factory installed and, unless the original fluid in the system has been drained/flushed/replaced, no additional dye is necessary.



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Fig. 4—Flow Control Valve

CAUTION: If the fluid reservoir cap is not properly tightened after a fluid level inspection, the result can be fluid leakage and possible loss of the cap. Ensure that the cap is securely tightened when installing it.

(1) Power steering fluid leaks are possible from the steering gear as well as the pump, hoses, and fittings.

(2) Raise and support the front of the vehicle. Clean the exterior surfaces of the steering gear, the pump, the reservoir, the hoses and the fittings thoroughly.

(3) Inspect and correct the fluid level in the reservoir. If the reservoir is overfilled, drain the excess fluid down to the correct level before proceeding.

(4) Inspect for aerated/foaming (milky color) fluid, which can cause an overflow from the reservoir and be mistaken for an actual fluid leak.

(5) Inspect and tighten all the hose fitting connections at the steering gear and at the pump.

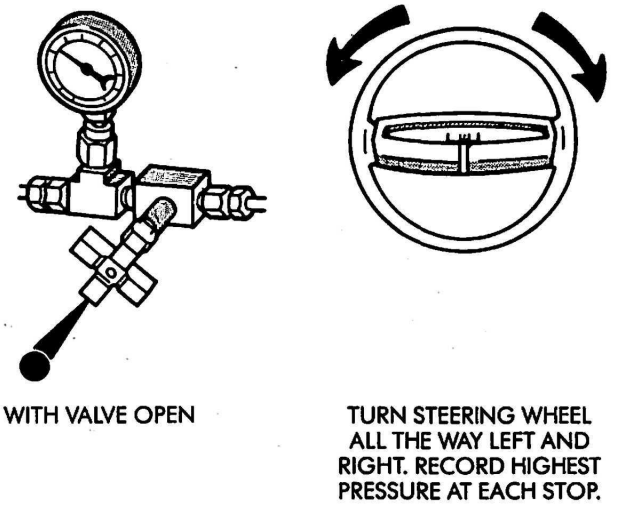
(6) Start the engine. Have a helper turn the steering wheel to the left and to the right several times while you search for the source(s) of the fluid leak(s). Contact the steering stops momentarily in each direction. Stop the engine when the source of the fluid leak is located.

(7) Repair or replace the source of the leak.

(8) Remove the support and lower the vehicle.

Aerated Fluid—Purge

Foaming, milky-red colored power steering fluid is generally the result of air in the fluid. Air can enter the system during repairs or can be drawn in by the pump when system fluid is low.



J8919-66

Fig. 5—Pump Operating Against Steering Stops

Because air is compressible, it must be eliminated from the fluid before normal steering action can be obtained.

If fluid aeration is visible in the reservoir, purge the air from the system according to the following instructions.

(1) Turn the engine off.

(2) Allow the fluid to cool for approximately 10-15 minutes.

(3) Inspect the reservoir fluid level. Add fluid if necessary.

(4) Start the engine.

(5) Slowly turn the steering wheel to the left and to the right but do not contact the steering stops in either direction.

(6) Stop the engine.

(7) Inspect the reservoir fluid level. Add fluid if necessary.

The purging procedure may have to be repeated several times to completely purge all the air from the system.

Pump Removal—3.0L V-6 Engine

(1) Raise and support the vehicle.½

(2) Remove the splash shield.

CAUTION: The serpentine drive belt tension must be released before removing the pump. Do not attempt to remove the pump without loosening the belt and releasing the tension because, otherwise, the pump pulley could be damaged.

(3) Release the serpentine drive belt tension (Fig. 1):

(a) loosen the alternator pivot bolt

(b) loosen the alternator adjustment slot bolt and

(c) turn the drive belt adjustment screw

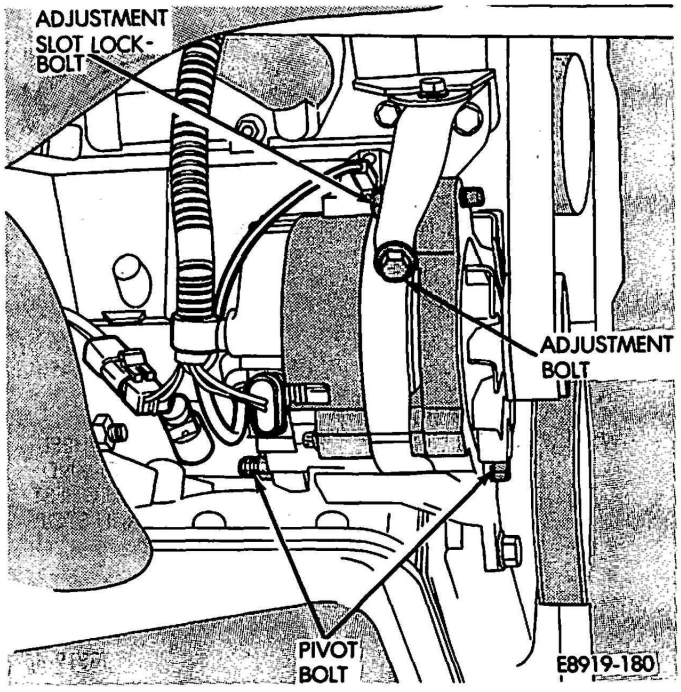


Fig. 1—Drive Belt Tension Release

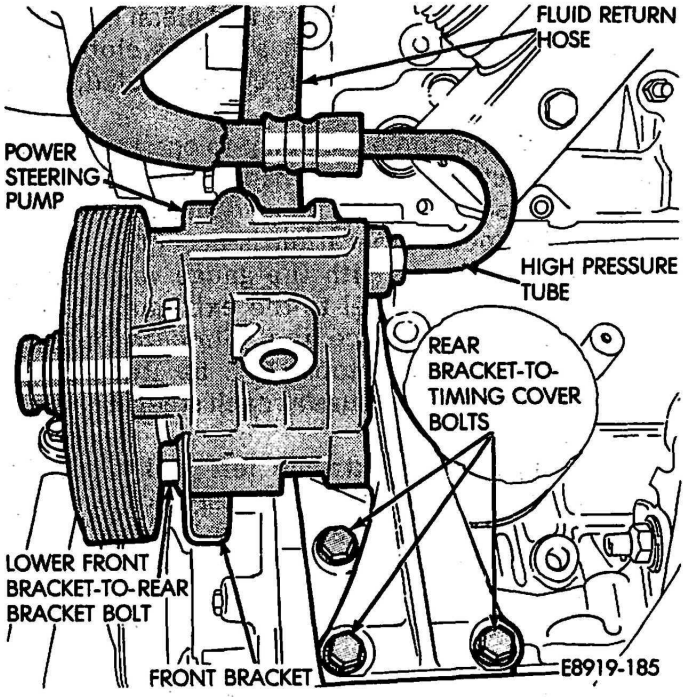


Fig. 2—3.0L P/S Pump

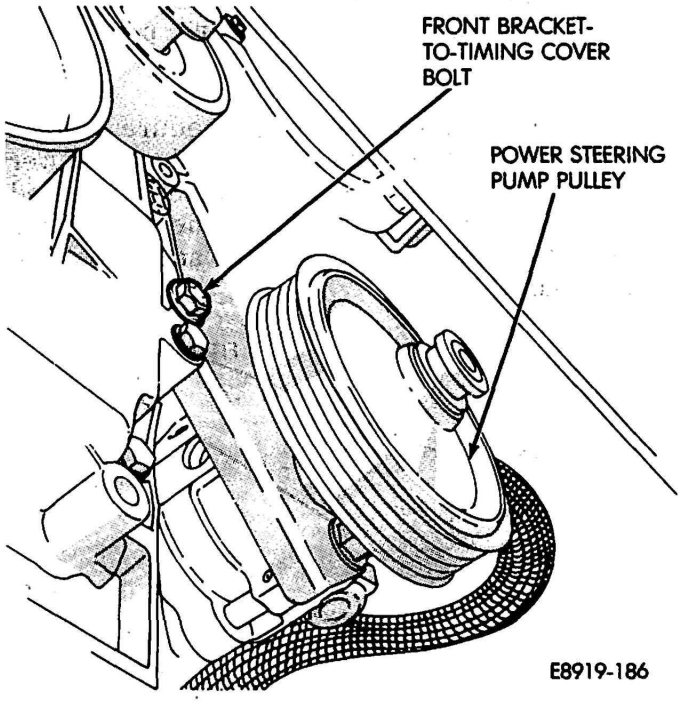


Fig. 3—Bracket-To-Timing Cover Bolt

(Fig. 1) counterclockwise until sufficient slack is obtained to separate the drive belt from the pump pulley.

(4) Place a drain pan under the power steering pump.

(5) Install a clamp on the pump fluid return hose (Fig. 2) to prevent excessive fluid spillage. Disconnect the fluid return hose from the pump.

(6) Disconnect the high-pressure tube fitting (Fig. 2) from the pump.

(7) Remove the pump rear bracket-to-sump bolts (Fig. 2).

(8) Remove the pump front bracket-to-timing cover bolt (Fig. 3).

(9) Remove the power steering pump and the brackets as a unit.

(10) If the pump is being replaced, remove the pulley and brackets from the pump (Fig. 4). Refer to the pulley removal and installation procedures (located within this Group) for detailed instructions.

Install the front bracket bracket-to-rear-bracket bolt (Fig. 4) before installing the pulley on the pump.

Pump Installation—3.0L V-6 Engine

(1) If the pulley is not installed on the pump, position the front bracket and insert the front bracket-to-rear-bracket bolt into the pump bore before installing the pulley (Fig. 4).

(2) If applicable, install the pump pulley. Refer to the pulley installation procedure (located within this Group) for detailed instructions.

(3) If not installed, attach the brackets to the pump but do not tighten the front bracket-to-rear-bracket bolt/nuts (Fig. 5) at this time.

(4) Place the pump with brackets at the installation position on the engine. Install the three rear bracket-to-timing-cover bolts finger-tight (Fig. 7).

(5) Install the pump front bracket-to-timing-cover bolt (Fig. 3) and tighten it with 27 N·m (20 ft-lbs) torque.

(6) Tighten the remaining pump bracket nuts and bolts with the specified torque in the following order:

(a) pump front bracket-to-rear-bracket bolt (Fig. 4, Fig. 5) with 40 N·m (30 ft. lbs.)

(b) pump bracket-to-bracket lower nut/stud (Fig. 4, Fig. 6) with 40 N·m (30 ft. lbs.).

(c) pump bracket-to-bracket upper stud (Fig. 4. Fig. 5) with 20 N·m (15 ft. lbs.).

(d) pump bracket-to-bracket upper nut (Fig. 4.) with 40 N· (30 ft lbs.) and

(e) pump rear bracket-to-sump bolts (Fig. 7, Fig. 9) with 40 N·m (30 ft. lbs.)

(7) Connect the fluid return hose to the pump.

(8) Remove the clamp from the fluid return hose.

The O-ring on the end of the high pressure tubing fitting must be replaced before the fitting is connected to the P/S pump.

(9) Replace the O-ring and connect the high pressure tubing fitting (Fig. 2) to the pump.

(10) Position the serpentine drive belt on the pump pulley and adjust the tension. If necessary, refer to the adjustment procedure (see Group 7, Cooling) for detailed instructions.

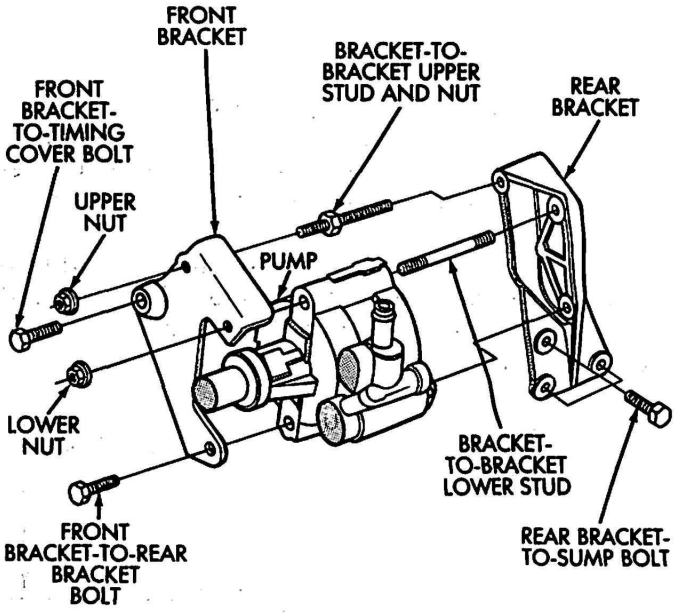


Fig. 4—Front & Rear P/S Pump Brackets

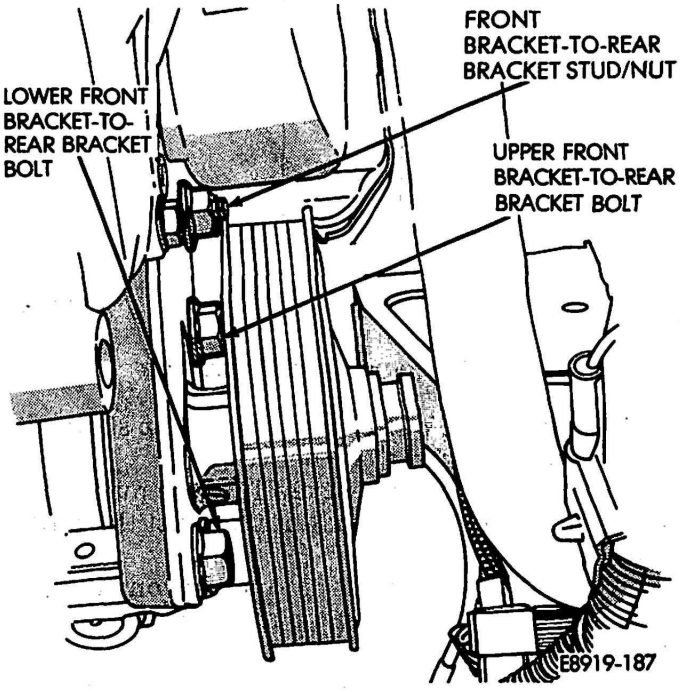


Fig. 5—Bracket-To-Bracket Nuts & Bolts

(11) Install the splash shield.

(12) Remove the support and lower the vehicle.

(13) Fill the pump reservoir with power steering fluid.

Pump Pulley

Removal

(1) Remove the pump assembly.

(2) Measure the distance that the pump shaft protrudes out from the pulley hub (Fig. 1). Record this protrusion measurement for installation reference.

(3) The replacement pulley (or the original pulley on a replacement pump) must be installed the same distance inward from the end of the pump shaft (Fig. 1).

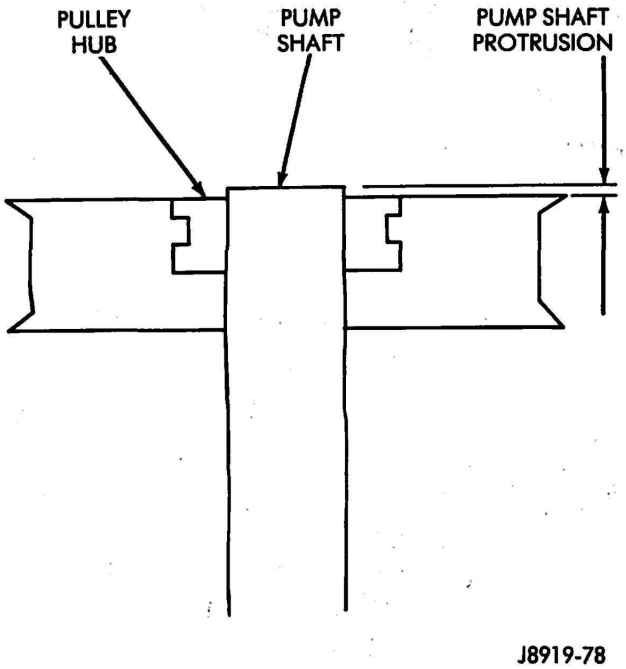


Fig. 1—Pump Shaft Protrusion

(4) Remove the pulley from the pump shaft with an appropriate removal tool (Fig. 2):

(a) Thread the tool screw into the pump shaft bore and position the tool nut against the pulley hub

(b) If the pump shaft extends beyond the pulley hub, install a spacer or a flat washer on the hub

(c) Install the removal tool puller rings around and in the pulley hub groove and the nut groove

(d) Install the tapered collar around the puller rings

(e) Tighten the tool nut to remove the pulley.

Installation

(1) Install the pulley on the pump shaft with an appropriate installation tool (Fig. 3).

(a) Position the pulley on the end of the pump shaft

(b) Place the spacer or a flat washer on the pulley hub

(c) Thread the screw into the pump shaft bore

(d) Tighten the tool nut to force the pulley the required distance on the shaft.

(2) Measure the distance that the pump shaft protrudes out from the pulley hub (Fig. 1). **Ensure that it is the same as the original protrusion.**

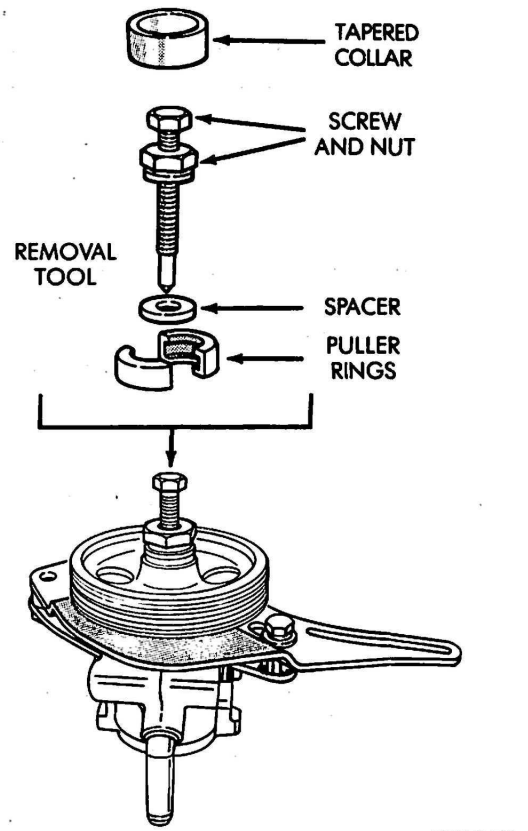


Fig. 2—Pump Pulley Removal

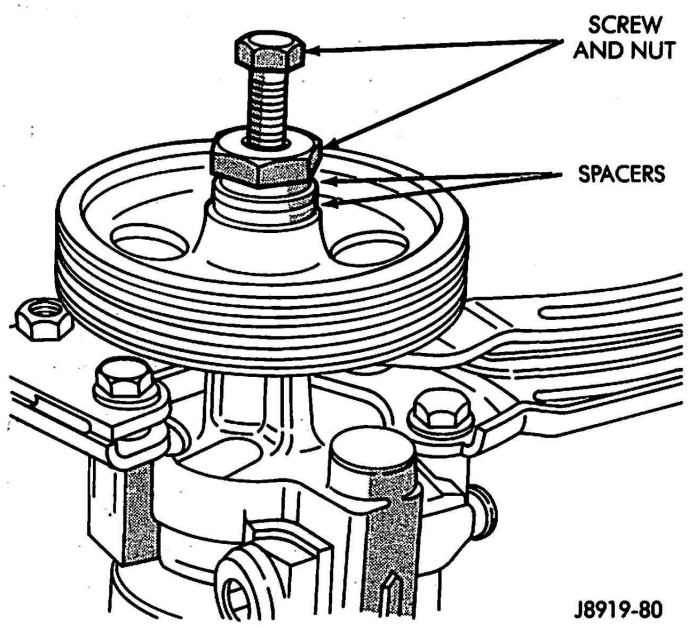


Fig. 3—Pump Pulley Installation

Pump Overhaul—3.0L V-6 Engine

Disassembly—N-Series Pump

(1) Remove the P/S pump. If necessary, refer to the removal procedure (located within this Group) for detailed instructions.

(2) Remove the pump brackets and the pulley. If necessary, refer to the pulley removal procedure (located within this Group) for detailed instructions.

WARNING: THE END PLATE COMPRESSES STRONG SPRING TENSION. DO NOT REMOVE THE END PLATE RETAINING RING WITHOUT FIRST RELIEVING THE SPRING TENSION THAT IS AGAINST THE RING BECAUSE, OTHERWISE, THE RETAINING RING COULD SUDDENLY DETACH FROM THE PUMP BODY BORE WITH STRONG FORCE.

(3) Remove the pump end plate retaining ring (Fig. 1) according to the following instructions:

(a) Position appropriate size socket wrenches against the pump shaft and against the end plate

(b) Clamp the pump and the socket wrenches in a vise

(c) Tighten the vise jaws on the socket wrenches and slightly compress the end plate

(d) Insert a small punch through the access hole in the pump body and force the retaining ring outward from the groove in the pump body bore

(e) Remove the retaining ring from the groove in the pump body bore with a small pry bar

(f) Slowly release the vise jaws and remove the pump body, the retaining ring and the socket wrenches from the vise.

(4) Clamp the pump body in a vise. Position wood blocks (Fig. 2) between the shaft end of the pump body and the vise jaws to avoid damaging the pump body or the shaft seal.

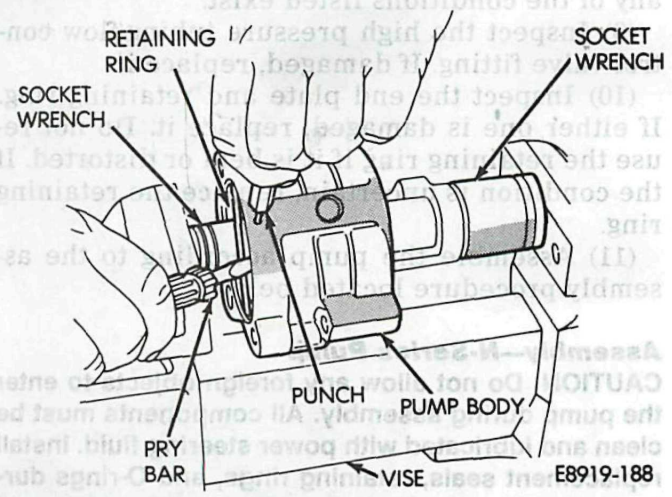


Fig. 1—End Plate Retaining Ring Removal

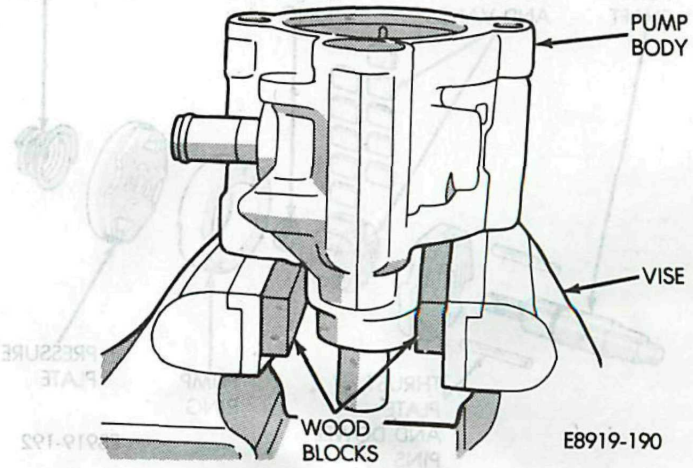


Fig. 2—Pump Clamped in A Vise

(5) Remove the end plate (Fig. 3) If the end plate is difficult to remove, rock it or tap it with a mallet to free it from the bore.

(6) Remove the fitting and the O-ring from the pump high pressure fluid port and remove flow control valve and spring (Fig. 3). Note the relative position of the valve and the spring for installation reference.

(7) Remove pressure plate spring and pressure plate (Fig. 4).

(8) Tap the pump shaft out of the pump body (Fig. 5).

(9) Remove the shaft retaining ring (Fig. 5).

(10) Remove the pump ring, the rotor and vanes, and the thrust plate from the pump shaft (Figs. 4 and 5).

(11) Remove the thrust plate dowel pins (Fig. 4).

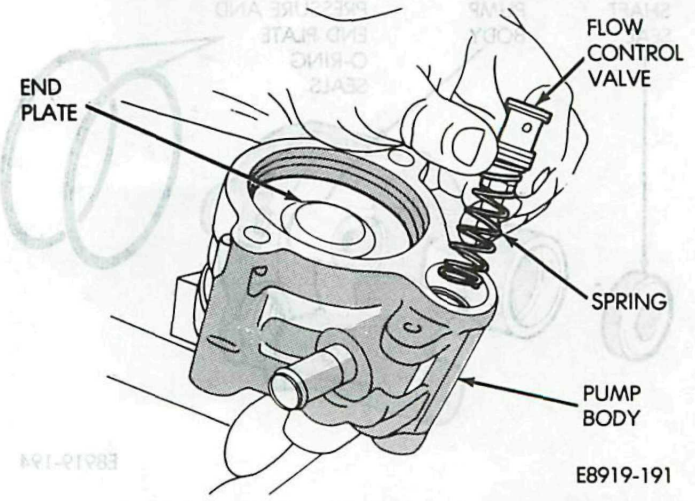


Fig. 3—End Plate & Flow Control Valve Removal

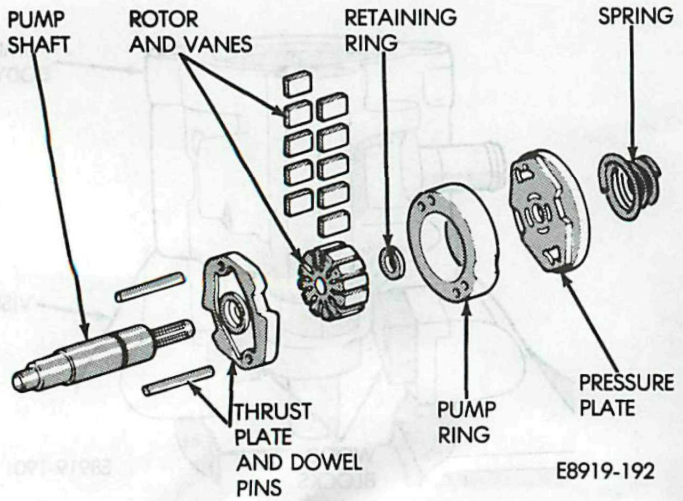


Fig. 4—Pump Components

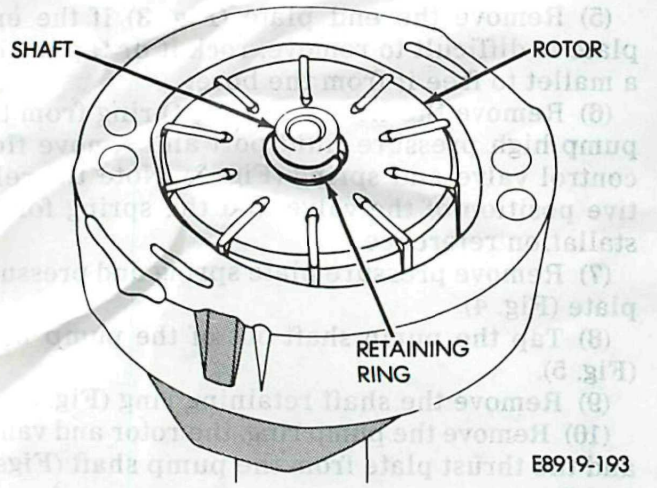


Fig. 5—Pump Shaft Removal

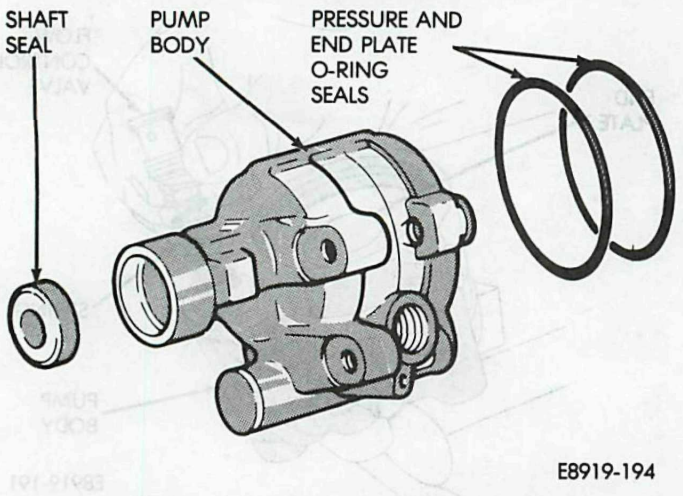


Fig. 6—End Plate O-Rings & Pump Shaft Seal

(12) Remove the pressure plate (Fig. 4) and the end plate O-ring (Fig. 6).

(13) Remove the pump shaft seal from the pump body (Fig. 6).

Cleaning and Inspection—N-Series Pump (Fig. 7)

(1) Clean with mineral spirits. Either dry the components with compressed air or wipe them dry with a clean, lint-free cloth. Replace all excessively worn or damaged components.

(2) Inspect the flow control valve and ensure that it slides freely in the pump body bore. If it binds, inspect both the valve and the pump body bore for foreign objects, scratches and burrs. Burrs can be removed with crocus cloth. Replace the valve or pump body if either are damaged and not repairable.

The flow control valve is serviced as a unit only and it must not be disassembled.

(3) Inspect the pressure plate and the thrust plate surfaces for flatness and, when installed, ensure that they will be parallel with the pump ring. Inspect all the associated components for cracks and scoring. Replace any component that is defective or damaged.

A highly polished surface always exists on the pressure plate, the thrust plate and the pump ring as a result of normal friction. Do not confuse this condition with scoring.

(4) Inspect the condition of the thrust plate dowel pins. Replace the dowel pins if they are worn, cracked, or distorted.

(5) Inspect the pressure plate spring. Replace the spring if collapsed or distorted.

(6) Inspect rotor and all rotor vanes for free movement in rotor slots.

(7) Inspect the pump shaft for worn splines, cracks, and other defects. Replace the discarded pump shaft retaining ring (it should not be reused).

(8) Inspect the pump body for wear, cracks, porosity and damage. Replace the pump body if any of the conditions listed exist.

(9) Inspect the high pressure tubing/flow control valve fitting. If damaged, replace it.

(10) Inspect the end plate and retaining ring. If either one is damaged, replace it. Do not reuse the retaining ring if it is bent or distorted. If the condition is uncertain, replace the retaining ring.

(11) Assemble the pump according to the assembly procedure located below.

Assembly—N-Series Pump

CAUTION: Do not allow any foreign objects to enter the pump during assembly. All components must be clean and lubricated with power steering fluid. Install replacement seals, retaining rings, and O-rings during assembly. Used, damaged and worn seals will cause leaks, noise and rapid wear after assembly.

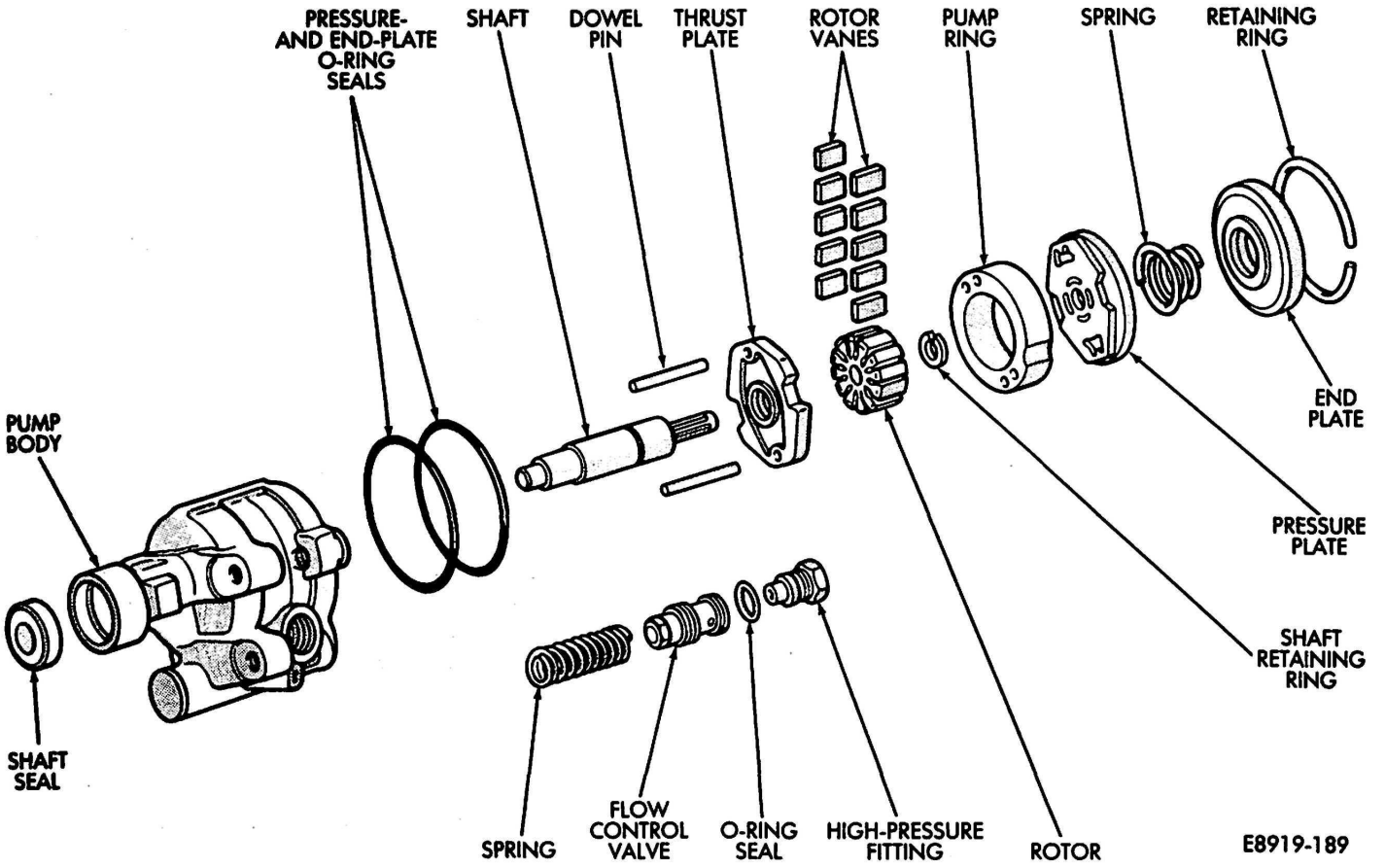


Fig. 7—N-Series Type Pump

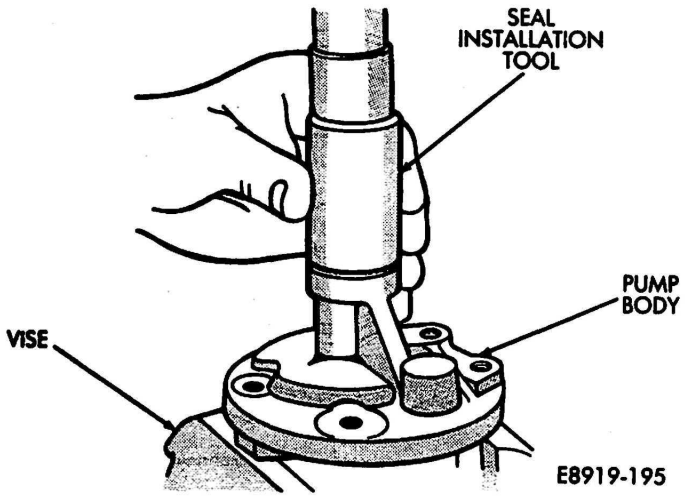


Fig. 8—Pump Shaft Seal Installation

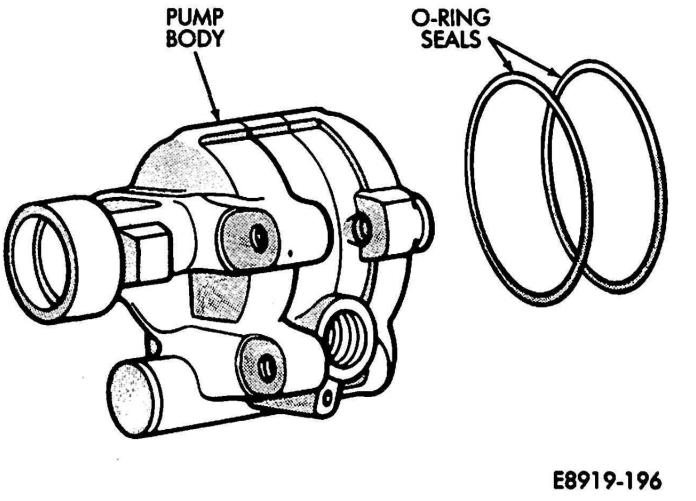


Fig. 9—O-Rings

(1) Clamp the pump body in a vise.
(2) Install the replacement pump shaft seal with an appropriate installation tool (Fig. 8).

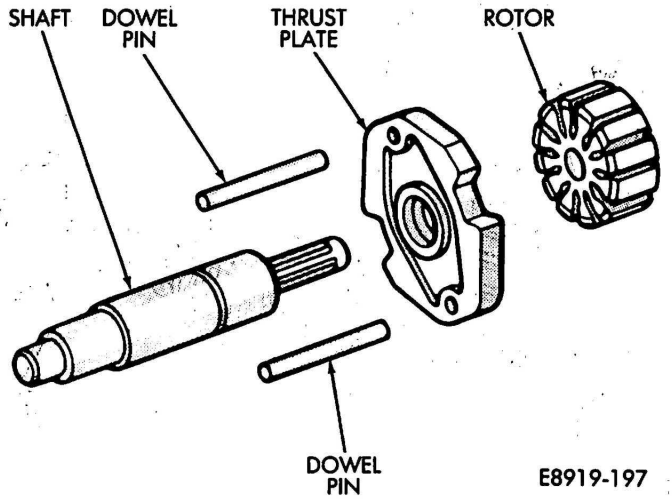


Fig. 10—Thrust Plate & Rotor Installation

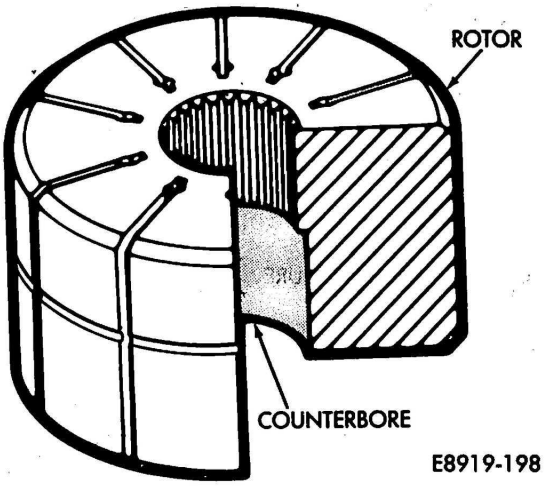


Fig. 11—Rotor Counterbore

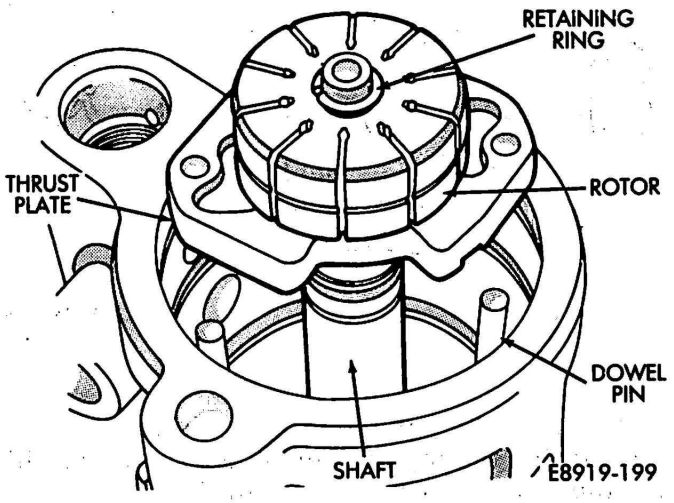


Fig. 12—Pump Shaft Retaining Ring

(3) Install the replacement pressure plate and end plate O-rings in the pump body (Fig. 9).

(4) Install the thrust plate dowel pins (Fig. 10) in the pump body.

(5) Install the thrust plate and the rotor on the pump shaft (Fig. 10).

Before proceeding, verify that the rotor is properly positioned. Ensure that the rotor is installed with the counterbore facing the thrust plate (Fig. 11).

(6) Secure the rotor and the thrust plate on the pump shaft with a replacement retaining ring (Fig. 12).

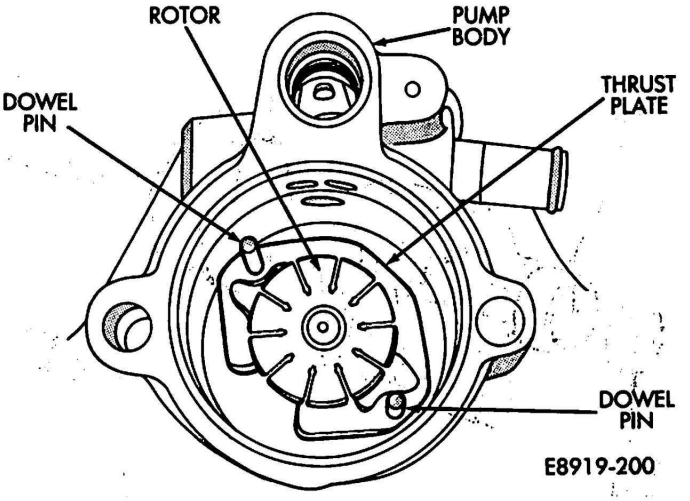


Fig. 13—Pump Shaft Installation

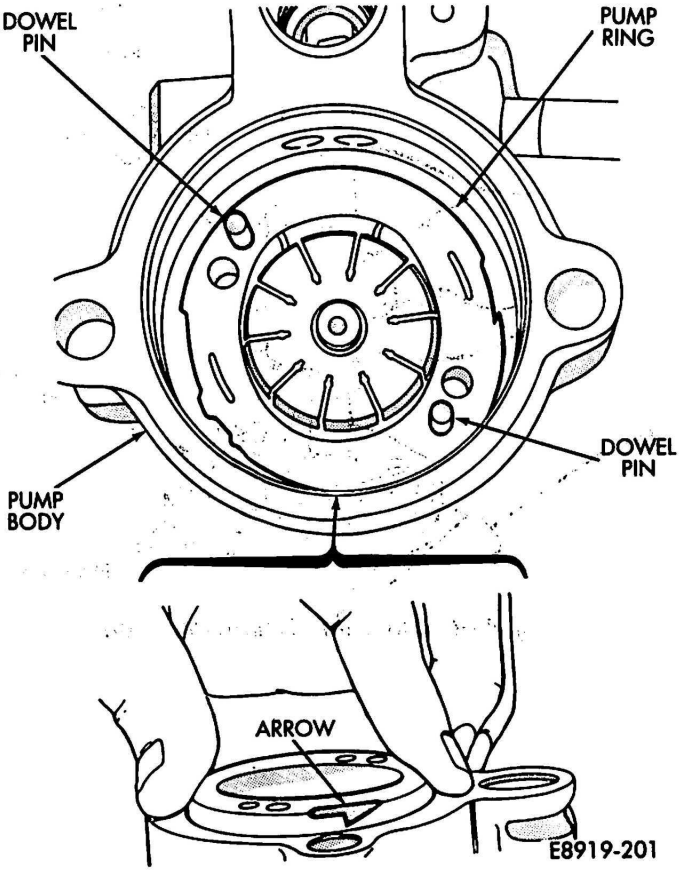


Fig. 14—Pump Ring Installation

(7) Align the thrust plate with the dowel pins and install the pump shaft, the rotor and the thrust plate in the pump body (Fig. 13).

(8) Align the pump ring with the dowel pins and install the pump ring over the rotor and on the thrust plate (Fig. 14).

Install the pump ring with the directional arrows (Fig. 14) facing up.

(9) Install the rotor vanes (Fig. 15) The rounded edge of each vane must face outward and toward the pump ring.

(10) Install the pressure plate. The spring groove in the plate must face outward (Fig. 16).

(11) Install the pressure plate spring in the spring groove (Fig. 16).

(12) Position the end plate in the pump body bore (Fig. 17).

WARNING: WHEN COMPRESSED, THE PRESSURE PLATE SPRING WILL EXERT STRONG SPRING TENSION AGAINST THE END PLATE. DO NOT ATTEMPT TO INSTALL THE END PLATE RETAINING RING WITHOUT FIRST RELIEVING THE PRESSURE PLATE SPRING TENSION ACCORDING TO THE INSTRUCTIONS LISTED BELOW.

(13) Install the end plate retaining ring (Figs. 17 and 18) according to the following instructions:

(a) with the end plate retaining ring placed against the end plate, position appropriate size socket wrenches against the pump shaft and against the end plate

(b) clamp the pump and the socket wrenches in a vise

(c) tighten the vise to slightly compress the end plate against the pressure plate spring tension

(d) force the end plate retaining ring into the pump body bore groove with a small pry bar

(e) remove the pump and the socket wrenches from the vise.

(14) Install the flow control valve and the spring in the pump body bore (Fig. 19). The hex-nut end of the valve faces toward the bore.

(15) Install a replacement O-ring on the high pressure tubing/flow control valve fitting and install the fitting in the pump body bore (Fig. 20). Tighten the fitting with 75 N·m (55 ft. lbs) torque.

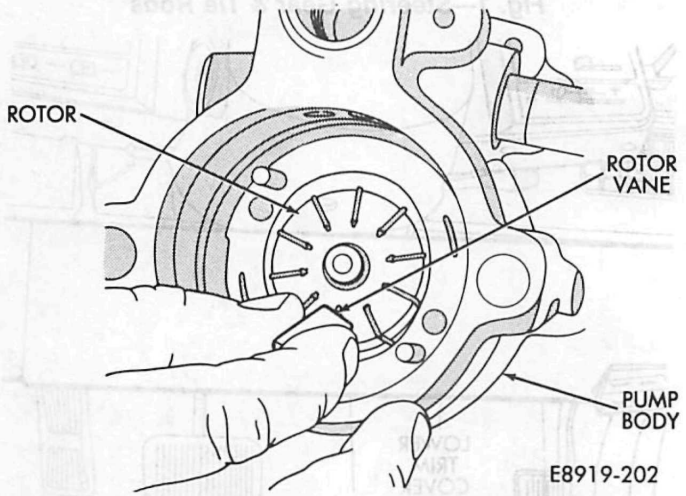


Fig. 15—Rotor Vane Installation

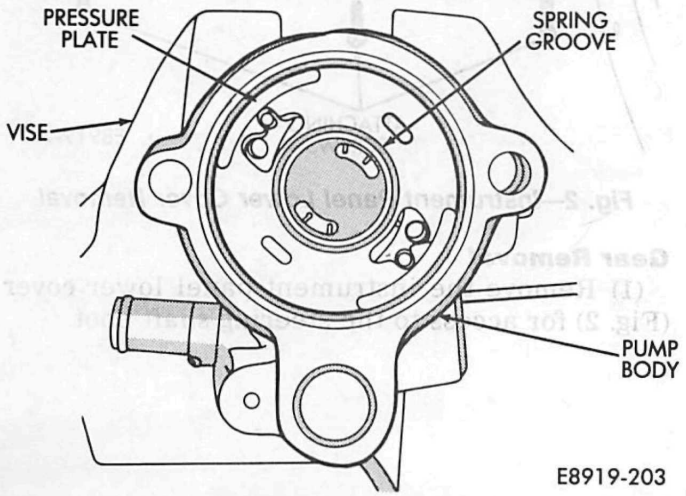


Fig. 16—Pressure Plate Installation

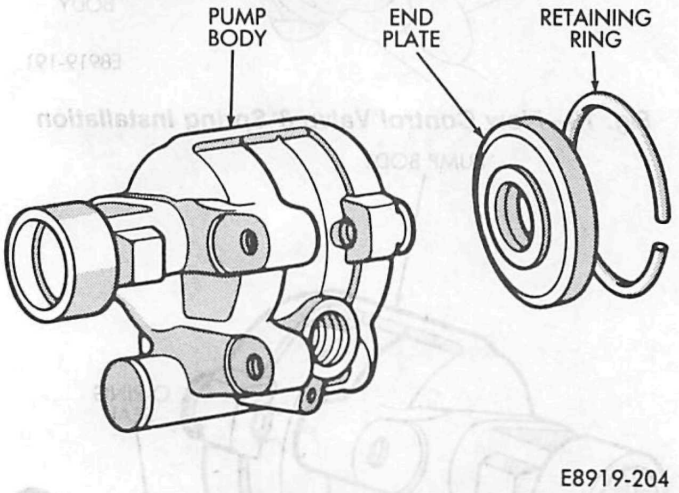


Fig. 17—End Plate & Retaining Ring

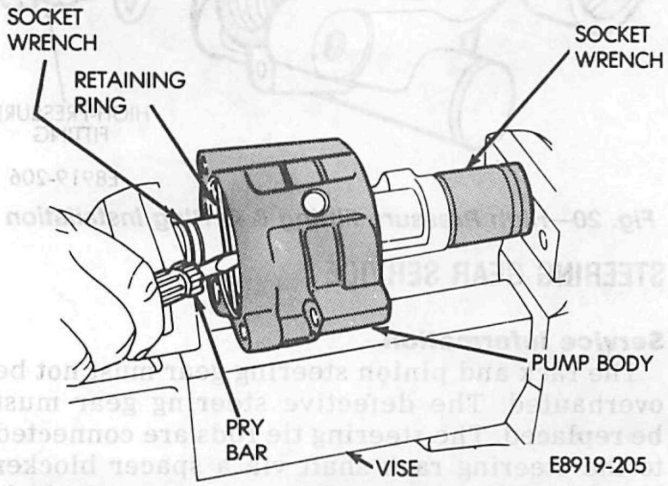


Fig. 18—End Plate Retaining Ring Installation

(16) Install the pump shaft pulley. If necessary, refer to the installation procedure (located within this Group) for detailed instructions.

The O-ring on the end of the high pressure tubing fitting must be replaced before the fitting is connected to the P/S pump.

(17) Install the P/S pump on the engine. If necessary, refer to the installation procedure (located within this Group) for detailed instructions.

(18) Refill the pump reservoir.

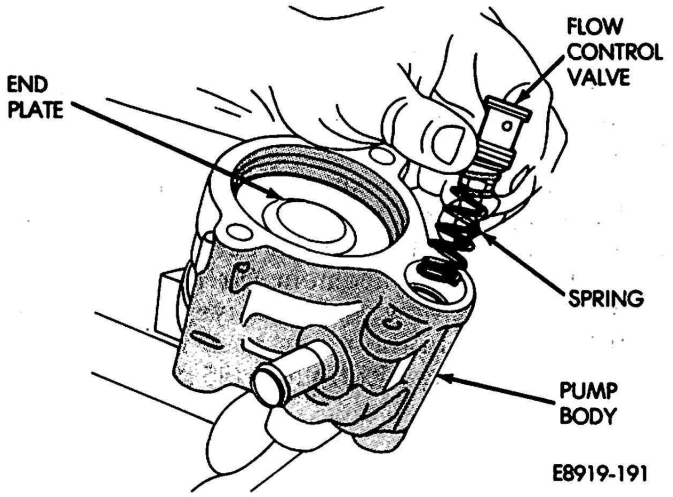


Fig. 19—Flow Control Valve & Spring Installation

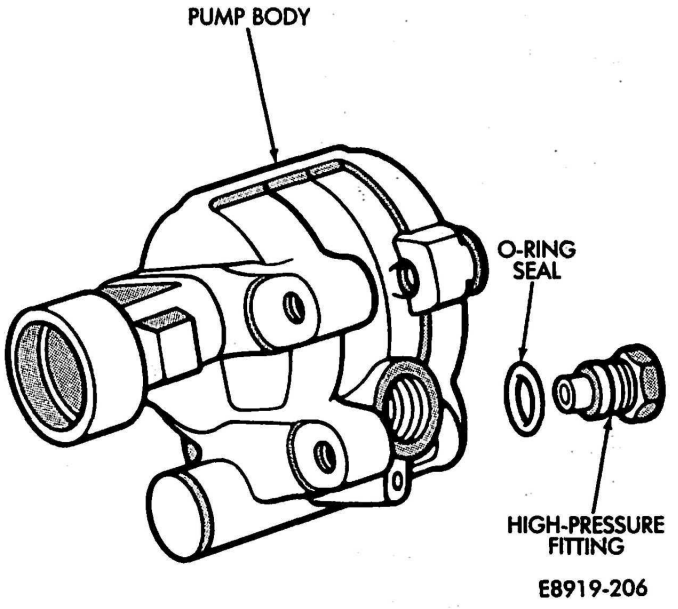


Fig. 20—High Pressure Fitting & O-Ring Installation

STEERING GEAR SERVICE

Service Information

The rack and pinion steering gear must not be overhauled. The defective steering gear must be replaced. The steering tie rods are connected to the steering rack shaft via a spacer blocker located at the center of the steering rack shaft. The tie-rod ends are connected to the strut body brackets.

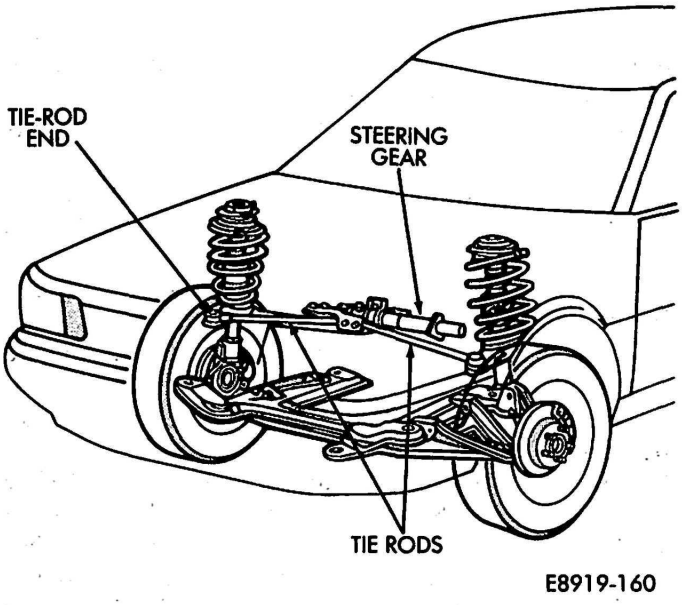


Fig. 1—Steering Gear & Tie Rods

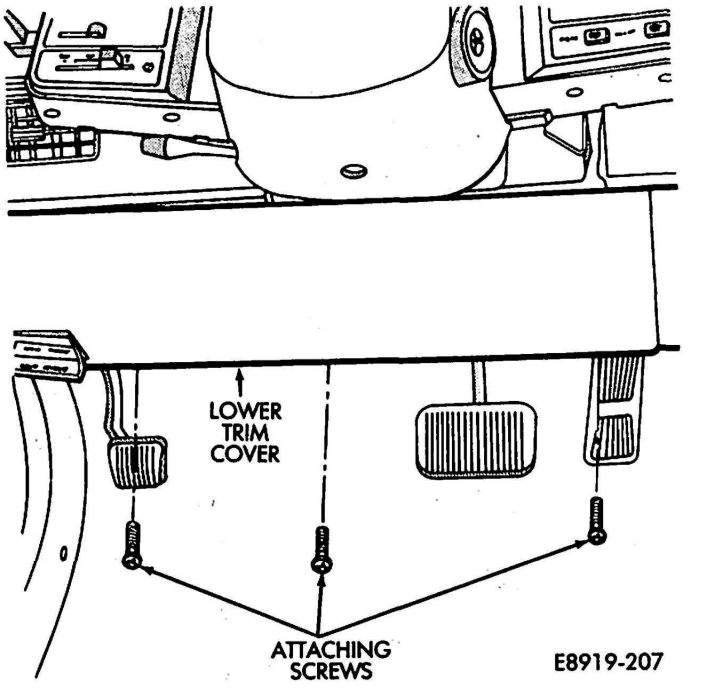


Fig. 2—Instrument Panel Lower Cover Removal

Gear Removal

(1) Remove the instrument panel lower cover (Fig. 2) for access to the steering shaft boot.

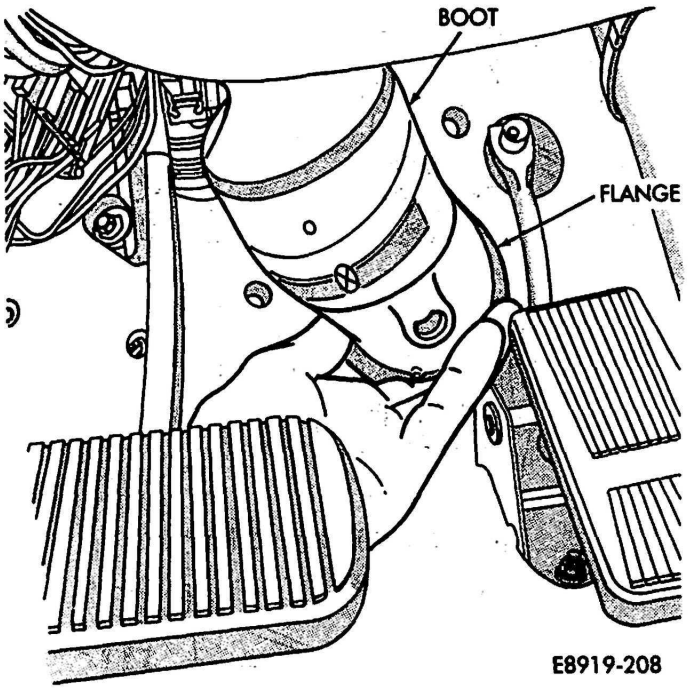


Fig. 3—Steering Shaft Boot

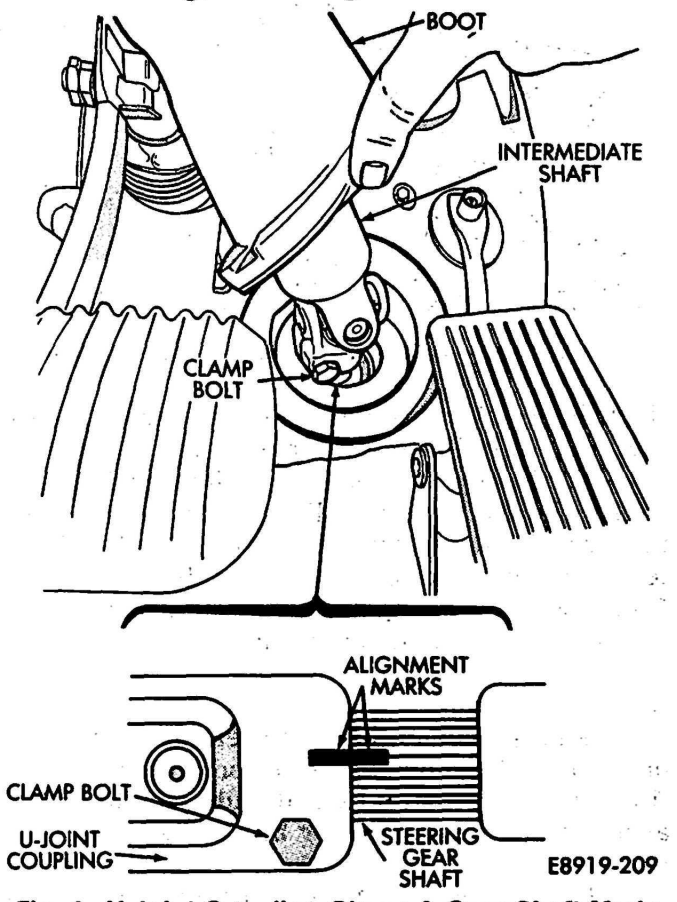


Fig. 4—U-Joint Coupling Clamp & Gear Shaft Marks

(2) Detach the steering shaft boot flange from the dash panel opening (Fig. 3).

The lower boot-half must be moved upward for access to the intermediate shaft U-joint and coupling clamp bolt (Fig. 3).

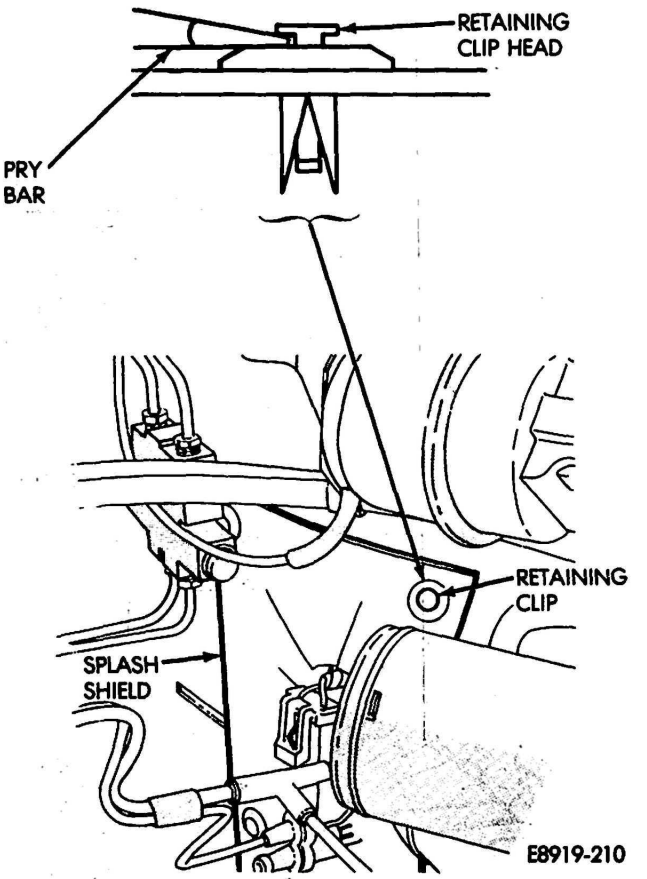


Fig. 5—Splash Shield Removal

(3) Slide the lower boot-half upward on the intermediate shaft for access to the shaft U-joint coupling clamp bolt (Fig. 4).

(4) Loosen and remove the U-joint coupling clamp bolt (Fig. 4).

(5) Score alignment marks on the intermediate shaft U-joint coupling clamp and on the steering gear shaft (Fig. 4) for installation reference.

(6) Remove the splash shield retaining clips and remove the shield from the dash panel in the engine compartment (Fig. 5).

Use a small pry bar (Fig. 5) to pry the retaining clips outward. Position the pry bar under the retaining clip heads as indicated.

(7) Remove either left or right tie rod end assembly attaching bolt and disengage tie rod end from steering gear. Reinstall bolt removed, finger tight. Repeat above to remove the remaining bolt attaching tie rod assembly. This removes outer tie rod end assemblies from steering gear for easier removal.

(8) Detach the power steering gear fluid tubing from the retaining block slots (Fig. 7).

CAUTION: The steering gear fluid tubing fittings are not flared, instead, they have ring seals. When the tubing fittings are removed, the ring seals must be replaced before the fittings are installed to avoid

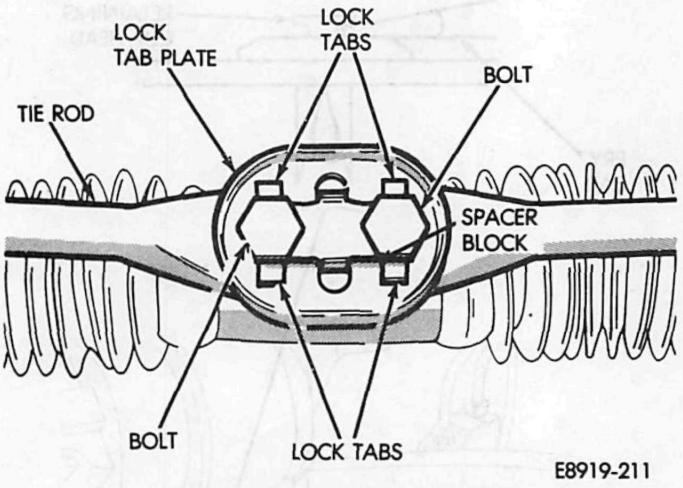


Fig. 6—The Rod Bolt Lock Tabs

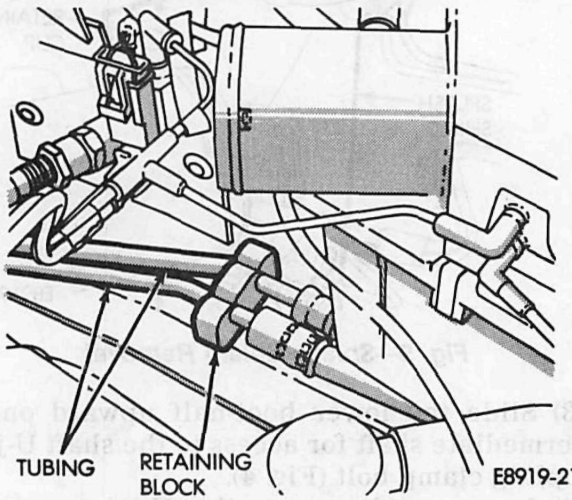


Fig. 7—Fluid Tubing Removal

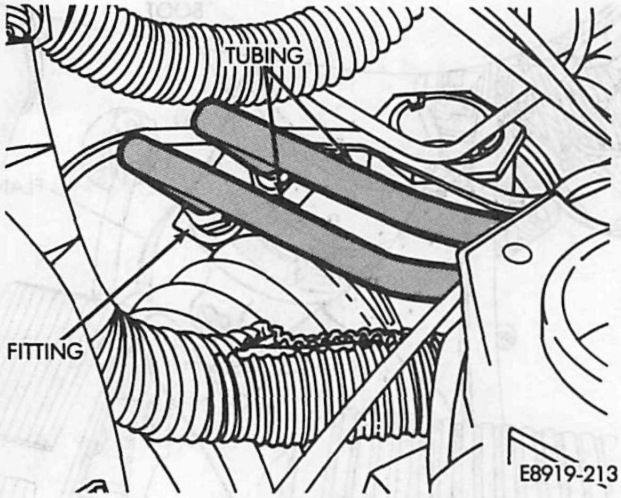


Fig. 8—Fluid Tubing & Fittings

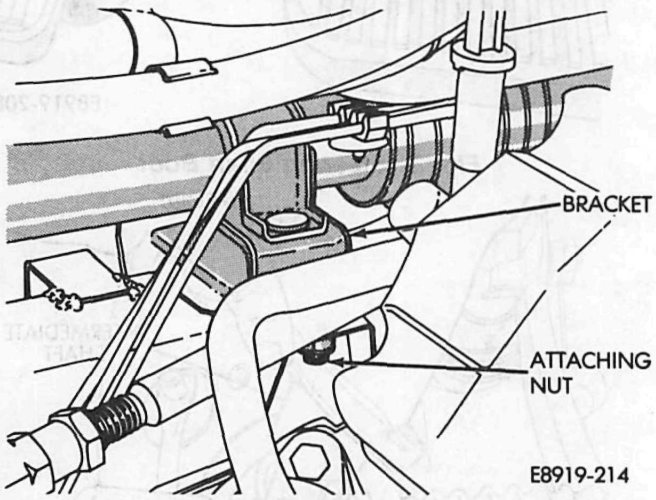


Fig. 9—Steering Gear Bracket Right-Front Nut

potential fluid leaks. In addition, the seal installation tools referenced in the replacement procedure must be used. The ring seals must be enlarged for installation, then compressed back to their original size after they have been fitted over the tubing lips.

(9) Position a drain pan under the steering gear and disconnect the power steering fluid tubing fittings (Fig. 8) from the steering gear.

(10) Remove the steering gear bracket right-front attaching nut from the stud (Fig. 9).

(11) Raise and support the vehicle.

(12) Remove the left front wheel/tire.

(13) Remove the nuts attaching the tie-rod end ball studs to the strut body brackets.

(14) Disconnect the tie-rod end ball studs from the strut body brackets with an appropriate removal tool (Fig. 10).

(15) From under the vehicle, remove the three bolts that attach the steering gear brackets to the crossmember support (Fig. 11).

(16) Remove the steering gear and the attached tie rods (Fig. 11) through the tie rod access opening in the left, inner fender panel.

(17) To help in the removal of the steering gear, retain the tie rods parallel to the gear during removal. If necessary, the tie rods can be either temporarily taped or tie-wrapped to the gear.

CAUTION: The steering gear fluid tubing fittings have ring seals (Fig. 12) The fittings are not flared.

Gear Installation

Install replacement steering gear assembly with outer tie rod removed and tie rod attaching bolts finger tight. Reinstall tie rod end assemblies one at a time to insure spacer block assembly is in place.

(1) Insert the steering gear through the tie rod access opening in the left, inner fender panel.

(2) Position the gear on the crossmember support and install the bracket right-front attaching nut on the stud (Fig. 9). Tighten the nut to 55 N·m (40 ft. lbs.)

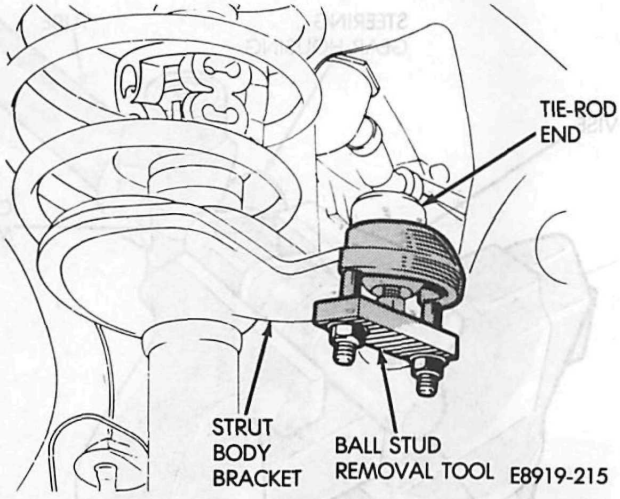


Fig. 10—Tie-Rod End Ball Stud Removal

(3) Raise and support the vehicle.

(4) From under the vehicle, install the 3 bracket attaching bolts (Fig. 11). Tighten the bolts with 55 N·m (40 ft. lbs.).

(5) Attach the tie-rod ends to the strut body brackets. Tighten the tie-rod end ball stud nuts to 48 N·m (35 ft. lbs.).

(6) Install the left front wheel/tire. Tighten steel wheel lug nuts with 85 N·m (63 ft. lbs.) torque. Tighten aluminum wheel lug nuts to 122 N·m (90 ft. lbs.).

(7) Remove the support and lower the vehicle.

(8) Connect the power steering pump fluid tubing fittings to the steering gear (Fig. 8). Tighten the fittings to 30 N·m (22 ft. lbs.).

(9) Insert the fluid tubing into the retaining block slots (Fig. 7).

(10) Tighten the bolts (Fig. 6) that attach the tie rods to the steering rack shaft spacer block to 75 N·m (55 ft. lbs.).

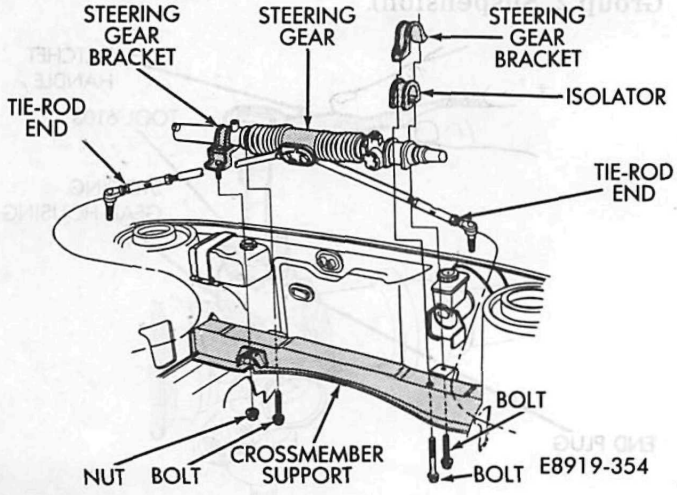


Fig. 11—Steering Gear, Brackets & Bolts

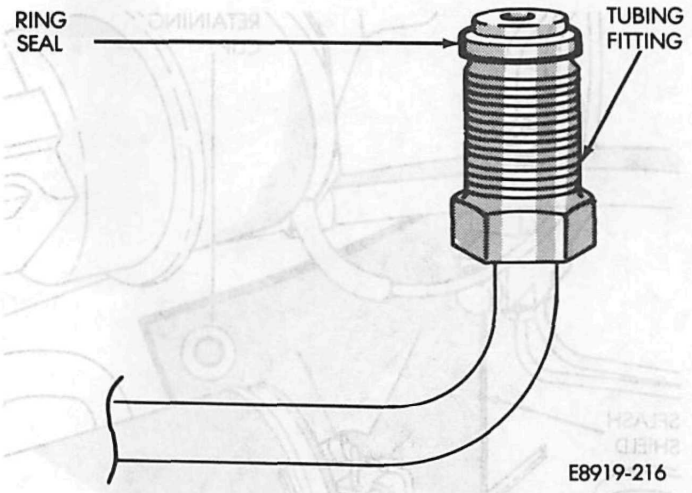


Fig. 12—Tubing Fitting & Ring Seal

(11) Bend the lock tabs (Fig. 6) over the tie rod attaching bolt heads.

(12) Install the splash shield on the dash panel (Fig. 14). Position the shield on the dash panel and secure with the retaining clips.

(13) Under the instrument panel, align the intermediate shaft U-joint coupling clamp and the steering gear shaft installation reference alignment marks that were scored during the removal of the steering gear (Fig. 4).

(14) With the reference marks aligned, insert the steering gear shaft into the intermediate shaft U-joint coupling clamp. Install and tighten the U-joint coupling clamp bolt to 40 N·m (25 ft. lbs.).

(15) Install the two-piece steering shaft boot (Fig. 15) according to the following instructions:

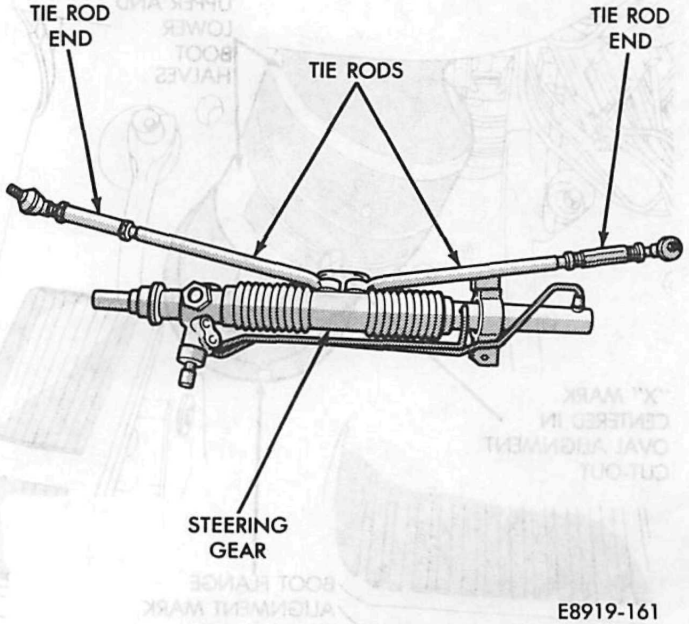


Fig. 13—Steering Gear & Tie Rods

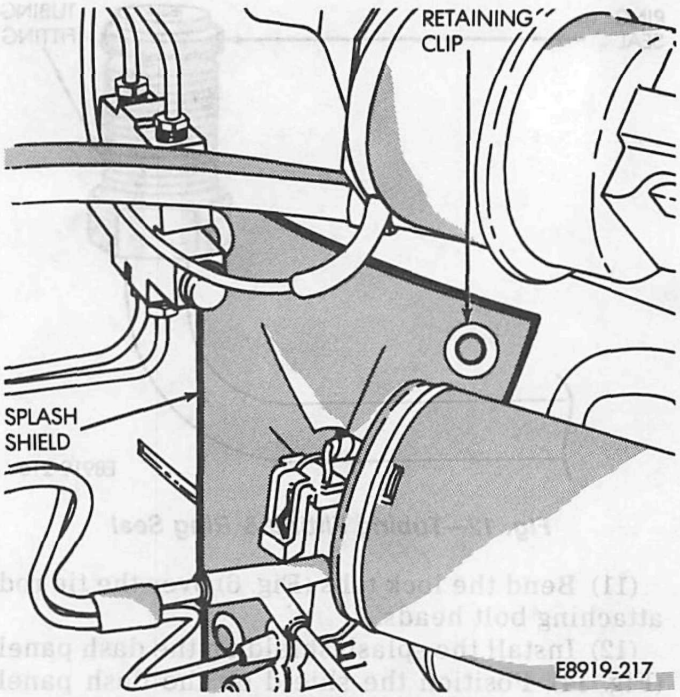


Fig. 14—Splash Shield Installation

(a) If the two halves of the boot have separated, insert the lower half into the upper half

(b) slide the lower boot-half downward over the intermediate steering shaft

(c) place the installation alignment mark on the lower boot-half metal flange at the 6 o'clock position and force the metal flange into the dash panel opening

(d) rotate the two halves of the boot until the X mark on the lower boot-half is centered in the oval shaped alignment cut-out in the upper boot-half. (Fig. 15).

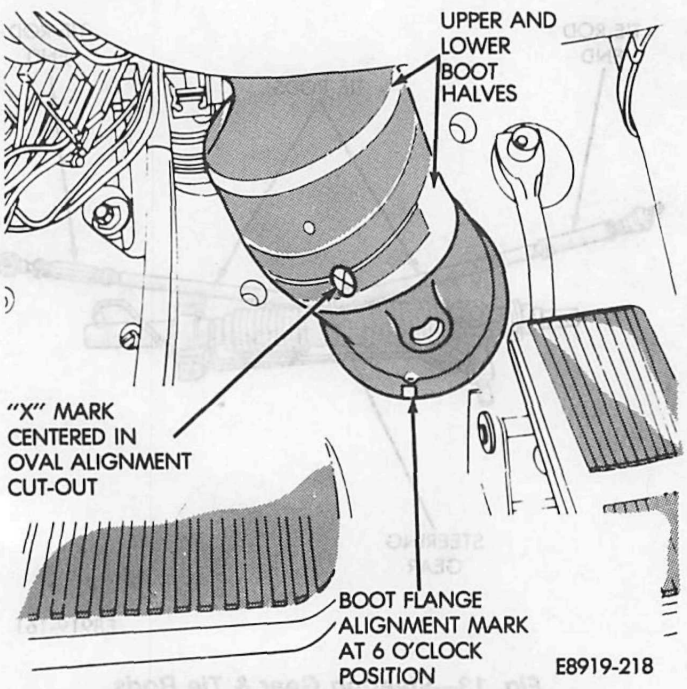


Fig. 15—Steering Shaft Boot Installation

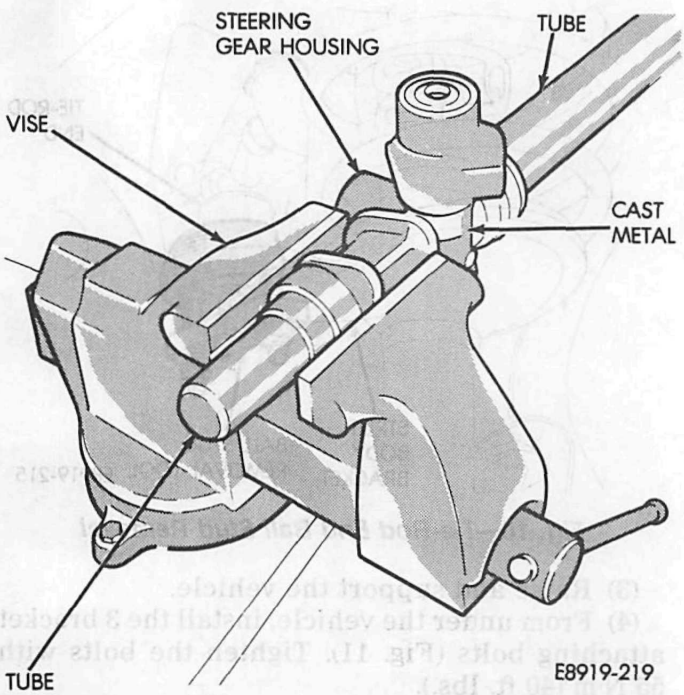


Fig. 16—Steering Gear Clamped in A Vise

(e) if necessary, seat the upper boot-half on the steering column

(f) verify that the lower boot-half X mark is centered in the oval shaped alignment cut-out in the upper boot-half and that the alignment mark on the lower boot-half metal flange is at the 6 o'clock position.

(16) Install the instrument panel lower cover.

(17) Refill the pump reservoir.

Because the tie-rod ends were removed from the strut body brackets, it is strongly recommended that front wheel toe position be measured and, if necessary, adjusted after the steering gear is installed. Refer to Front Wheel Alignment (See Group 2, Suspension).

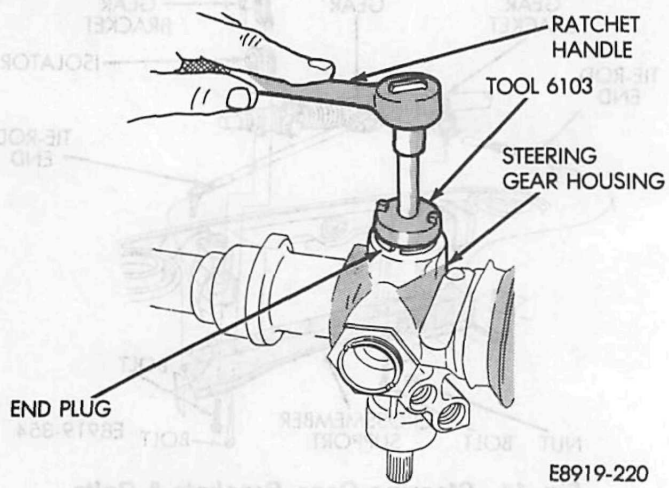


Fig. 17—End-Plug Removal

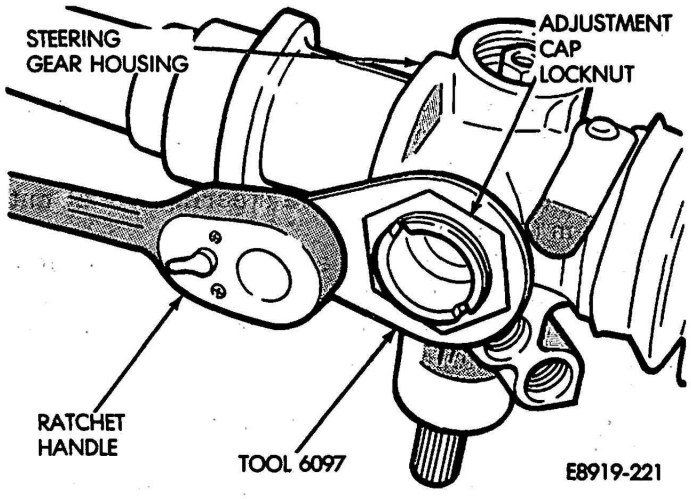


Fig. 18—Preload Adjustment Cap Locknut Removal

Steering Gear—Initial Operation

Service Information

For vehicles equipped with a 3.0L V-6 engine, the reservoir (Fig. 1) is located near the front of the left (driver side) cylinder head cover. Hoses are used to connect the fluid reservoirs to the pumps.

The correct fluid level is indicated at the full mark on the dipsticks. Use MOPAR power steering fluid, or equivalent to refill the system.

Operation

(1) Fill the P/S pump reservoir and operate the engine until the power steering fluid reaches the normal operating temperature of approximately 77°C (170°F), then stop the engine.

(2) Turn the wheels to a full-left-turn position and add power steering fluid until the reservoir is full.

(3) Start the engine. Operate it at high idle speed and then observe the fluid level on the dipstick. Add fluid, if necessary.

(4) Purge the system of air by turning the wheels from side-to-side without contacting the stops. Fluid with air in it (aerated) will foam and have a milky-red color. Maintain the reservoir full of fluid.

(5) Return the wheels to the straight-ahead position and operate the engine for an additional 2 to 3 minutes, then stop the engine.

(6) Road test the vehicle to ensure that the steering system functions normally and is free of noise. If noise or another malfunction occurs, refer to the power steering service diagnosis charts for a list of the most common causes for unusual noises, low pressure, and erratic/inconsistent system operation.

(7) Observe the fluid level. Add fluid as necessary to fill the reservoir with the system stabilized at the normal operating temperature.

CAUTION: If the fluid reservoir cap is not properly tightened after a fluid level inspection, the result can be fluid leakage and possible loss of the cap.

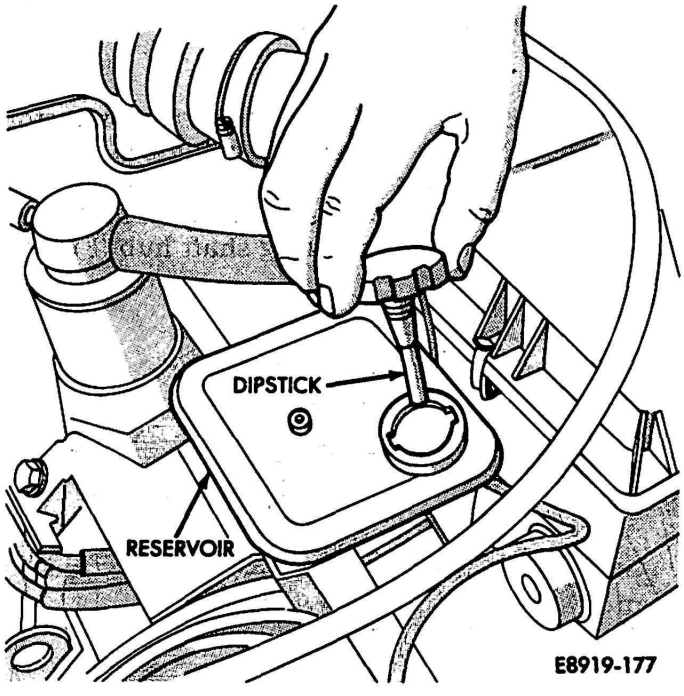


Fig. 1—3.0 V-6 Engine P/S Pump Reservoir

STEERING WHEEL

SERVICE PROCEDURES

Removal

(1) Detach the horn contact cover from the steering wheel (Fig. 1).

(2) Disconnect the horn wire connectors and remove the horn contact cover from the steering wheel (Fig. 1) Insulate the wire connectors with electrical tape.

(3) Note the position of the alignment reference mark on the end of the steering shaft hub (Fig. 2).

(4) Remove the steering shaft hub nut and slide the wheel off the shaft hub (Fig. 1, Fig. 2).

(5) Disconnect the speed control wire connector (if equipped) and remove the steering wheel from the steering column (Fig. 3).

Installation

(1) Connect the speed control wire connector (if equipped) to the steering column (Fig. 3).

(2) Align the turn signal cam alignment pin with the pin bore in the steering wheel and position the wheel on the steering shaft hub (Fig. 3).

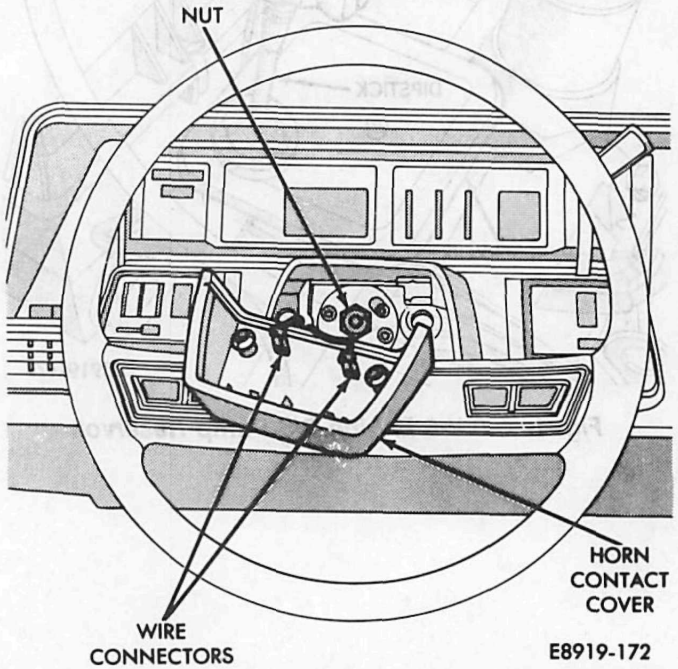


Fig. 1—Horn Contact Cover

(3) Align the steering wheel with the reference mark on the steering shaft hub and force it on the shaft hub (Fig. 2).

(4) Install and tighten the steering wheel nut to 70 N·m (ft. lbs.).

(5) If the steering wheel is slightly off-center (requires minor alignment), loosen the alignment screws enough to allow the screw shanks to slide within the alignment slots (Fig. 4).

(6) Rotate the steering wheel to the left or to the right as applicable to align (center) the wheel.

(7) Tighten the alignment screws (Fig. 4).

(8) Remove the electrical tape and connect the two horn wire connectors to the steering wheel horn contact cover (Fig. 1).

(9) Attach the horn contact cover to the steering wheel.

Alignment

If major alignment is necessary, refer to Steering Wheel—Alignment.

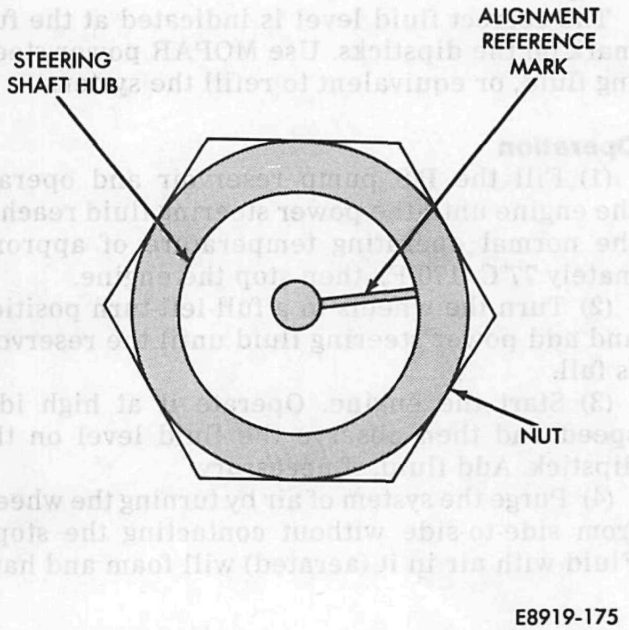


Fig. 2—Steering Shaft Reference Mark & Nut

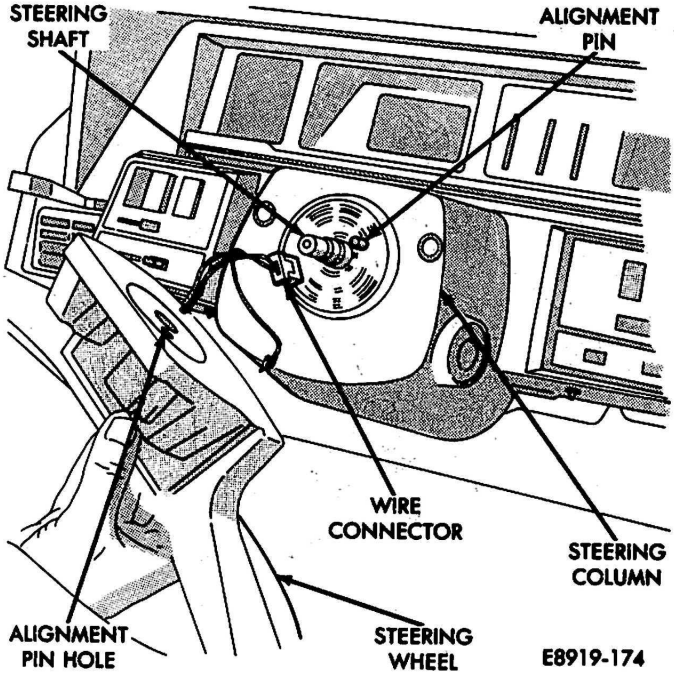


Fig. 3—Steering Wheel Removal/Installation

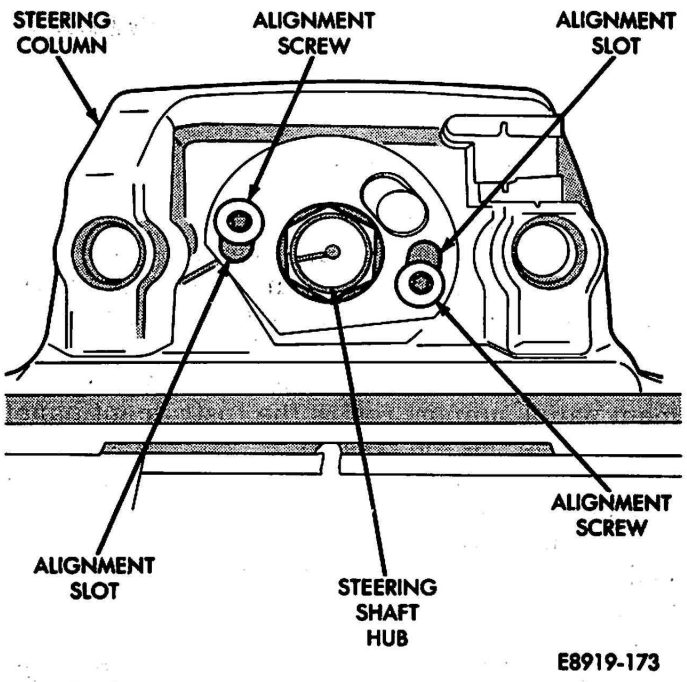


Fig. 4—Steering Wheel—Minor Alignment

STEERING COLUMNS

SERVICE PROCEDURES

Tilt and Nontilt Columns

Steering Column—Removal

(1) Disconnect the battery negative cable.

(2) Remove the screws that attach the instrument panel lower trim cover to the instrument panel and remove the cover (Fig. 1).

(3) Remove the screws that attach the instrument panel support rod to the instrument panel and remove the rod (Fig. 2).

(4) Disconnect steering column wire harness connector (Fig. 3).

(5) Remove the screw that attaches the dash panel wire harness connector to the dash panel (Fig. 3).

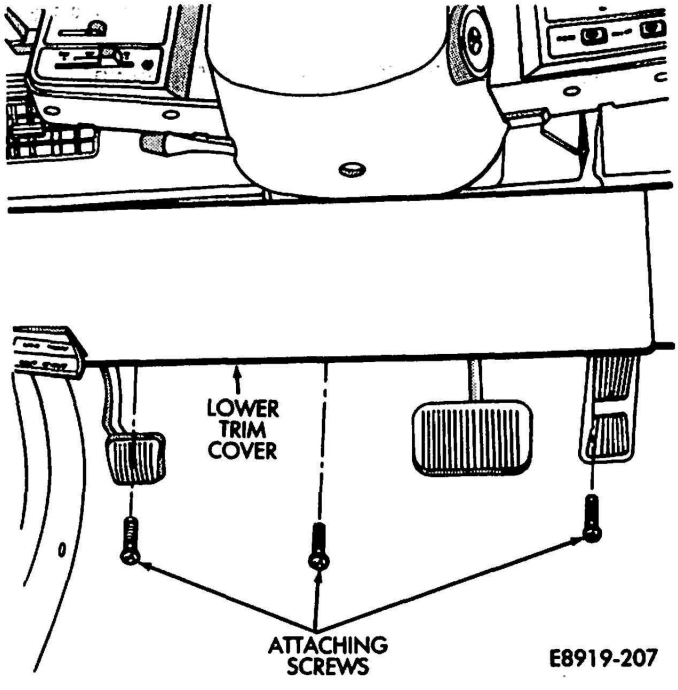


Fig. 1—I/P Lower Trim Cover

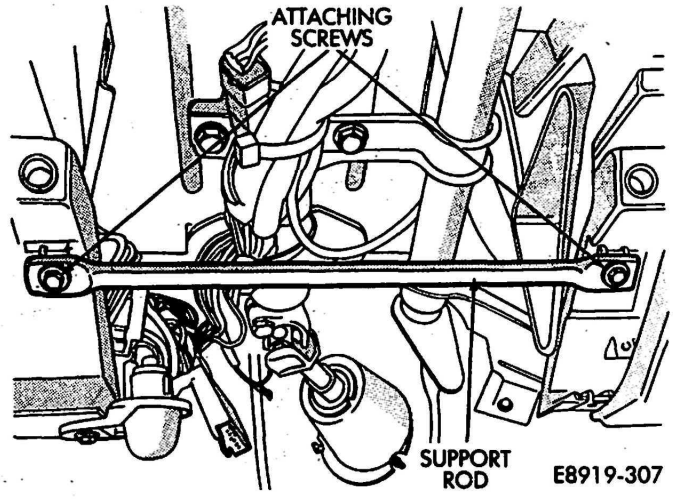


Fig. 2—I/P Support Rod

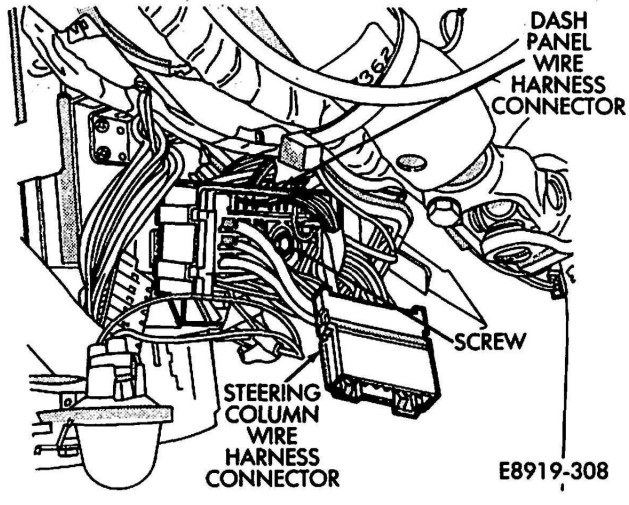


Fig. 3—Wire Harness Connectors

(6) Detach the steering column boot from the steering column. Slide the upper half of the two-piece boot downward over the lower half of the boot for access to the steering column shaft and the intermediate shaft U-joint (Fig. 4).

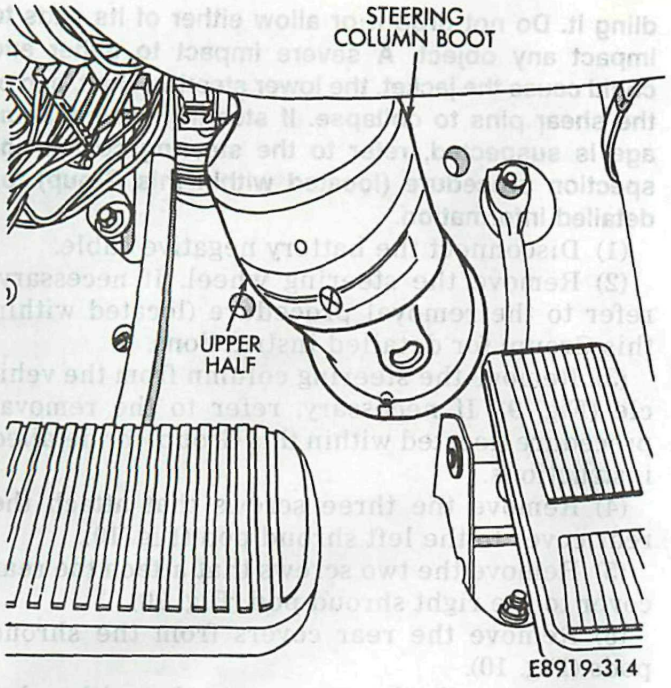


Fig. 4—Steering Column Boot

(7) Score an alignment mark on the steering column shaft and on the intermediate shaft U-joint coupling for installation alignment reference (Fig. 5).

(8) Remove the bolt from the intermediate steering shaft U-joint coupling clamp (Fig. 5).

(9) Remove the bolts and nuts that attach the steering column to the instrument panel (Fig. 6).

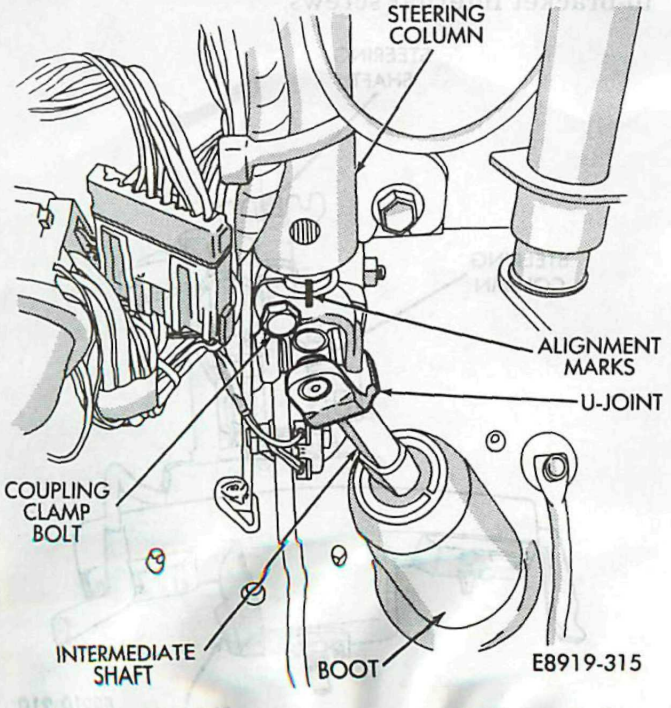


Fig. 5—Alignment Marks & U-Joint Clamp Bolt

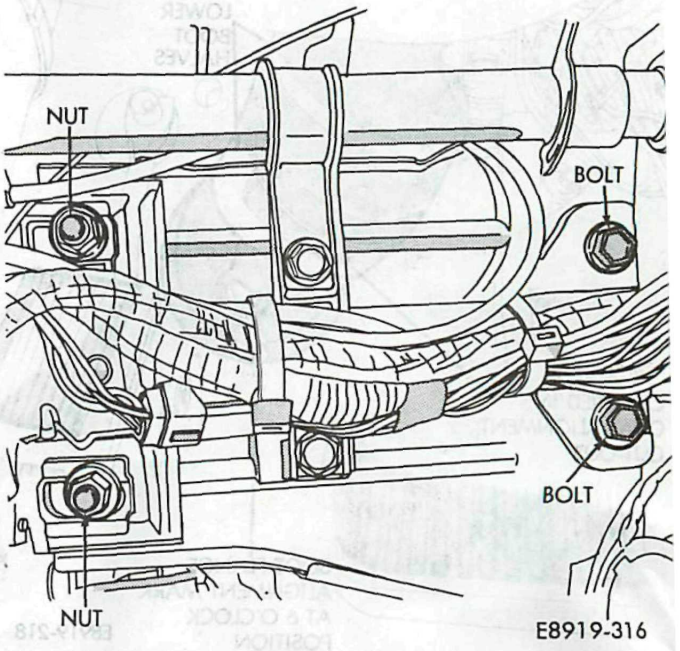


Fig. 6—Steering Column Attaching Nuts/Bolts

(10) Carefully lower the steering column to the vehicle floor. Disconnect the steering shaft from the intermediate shaft (Fig. 7).

(11) Remove the steering column from the vehicle.

Steering Column—Installation

(1) Align the two installation reference marks scored during removal and insert the steering shaft into the intermediate shaft U-joint coupling clamp (Fig. 4).

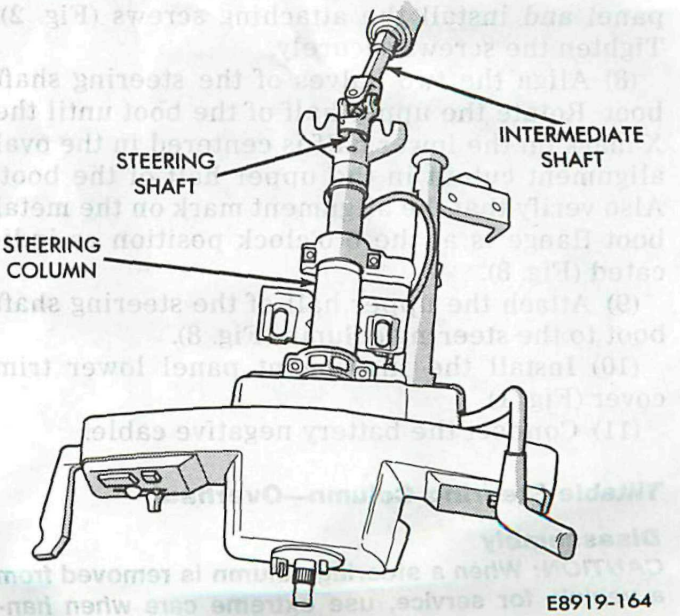


Fig. 7—Steering Column Removal

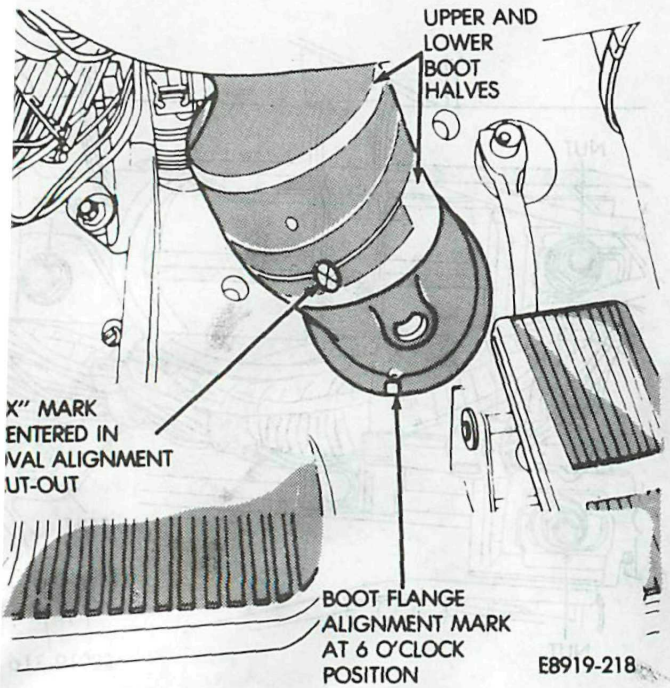


Fig. 8—Steering Column Boot Installation

(2) Install, but do not tighten, the intermediate shaft U-joint coupling clamp bolt (Fig. 4).

(3) Place the steering column in its normal position and install the nuts and bolts that attach the column to the instrument panel. Tighten the bolts/nuts to 45 N·m (33 ft. lbs.).

(4) Tighten the intermediate shaft U-joint coupling clamp bolt to 40 N·m (30 ft. lbs.).

(5) Position the wire harness connector on the dash panel and install attaching screw (Fig. 3).

(6) Connect steering column wire harness connector (Fig. 3).

(7) Position the support rod on the instrument panel and install the attaching screws (Fig. 2). Tighten the screws securely.

(8) Align the two halves of the steering shaft boot. Rotate the upper half of the boot until the X mark on the lower half is centered in the oval alignment cutout in the upper half of the boot. Also verify that the alignment mark on the metal boot flange is at the 6 o'clock position as indicated (Fig. 8).

(9) Attach the upper half of the steering shaft boot to the steering column (Fig. 8).

(10) Install the instrument panel lower trim cover (Fig. 1).

(11) Connect the battery negative cable.

Tiltable Steering Column—Overhaul

Disassembly

CAUTION: When a steering column is removed from a vehicle for service, use extreme care when handling it. Do not drop it or allow either of its ends to impact any object. A severe impact to either end could cause the jacket, the lower steering shaft, and/or the shear pins to collapse. If steering column damage is suspected, refer to the steering column inspection procedure (located within this Group) for detailed information.

(1) Disconnect the battery negative cable.

(2) Remove the steering wheel. If necessary, refer to the removal procedure (located within this Group) for detailed instructions.

(3) Remove the steering column from the vehicle (Fig. 9). If necessary, refer to the removal procedure (located within this Group) for detailed instructions.

(4) Remove the three screws that attach the rear cover to the left shroud pod (Fig. 10).

(5) Remove the two screws that attach the rear cover to the right shroud pod (Fig. 10).

(6) Remove the rear covers from the shroud pods (Fig. 10).

(7) Remove the lower cover-to-shroud bracket screw and carefully separate the lower cover from the upper cover by detaching the upper cover tab fasteners from the lower cover notches (Fig. 11).

(8) Remove the two shroud bracket-to-upper cover screws and remove the shroud upper cover (Fig. 11).

(9) Remove the shroud-to-control module screws and remove the control modules from the pods (Fig. 12). This will allow access to the four shroud-to-bracket internal screws.

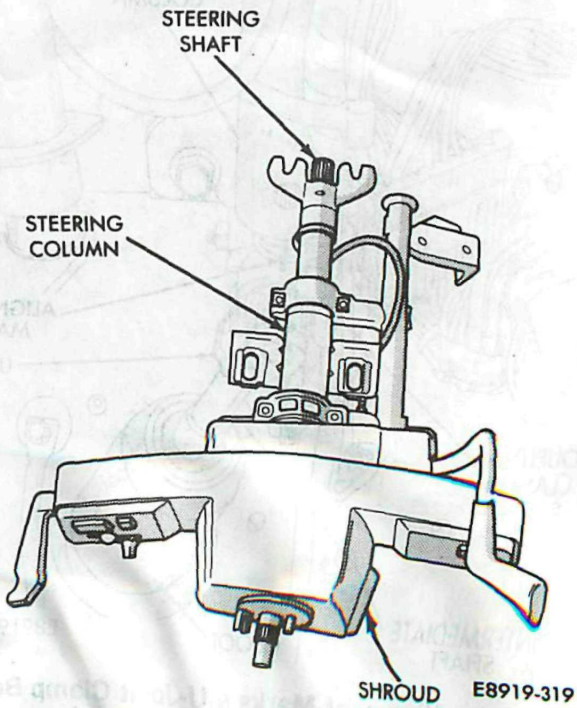


Fig. 9—Steering Column

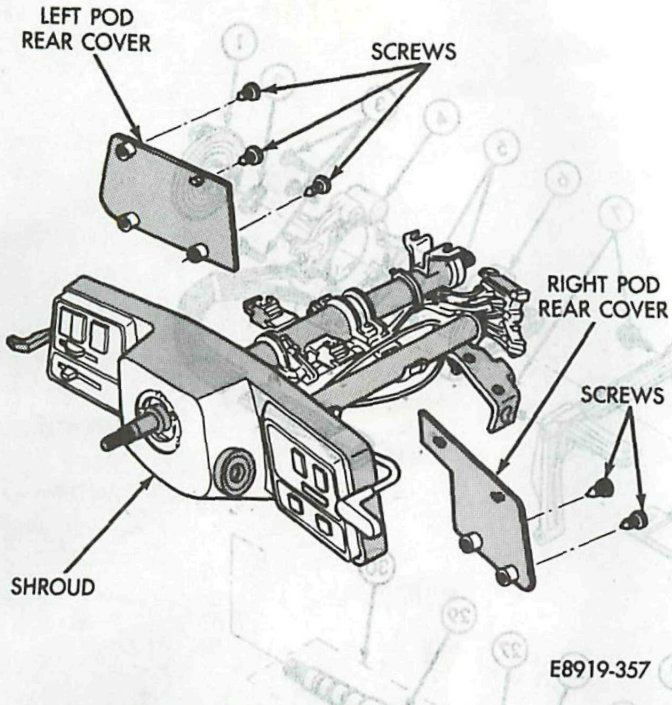


Fig. 10—Shroud Pod Rear Covers

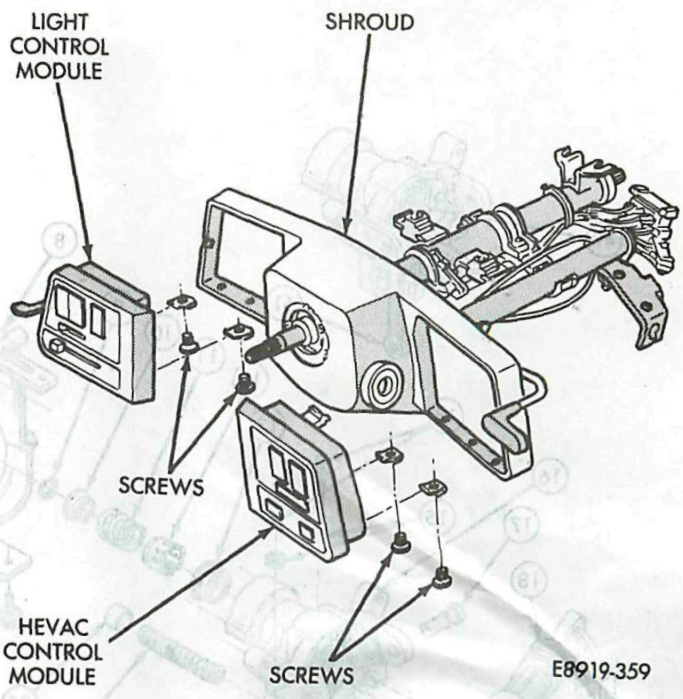


Fig. 12—Pod Control Modules

(10) Detach the key/lock cylinder bezel from the shroud (Fig. 13).

(11) Cover the tilt lever stalk with a shop towel and remove it by unthreading it from the tilt lever with locking pliers. **Use care to prevent defacing the stalk with the locking plier teeth.**

(12) Remove shroud-to-bracket internal screws (Fig. 13).

(13) Remove shroud from the shroud bracket (Fig. 13).

(14) Remove cancelling cam and wave washer from the turn signal switch (Fig. 14).

(15) Remove three turn signal switch retaining screws and remove the switch from the *switch* adapter (Fig. 14).

(16) Remove the three shroud bracket-to-steering column housing screws and remove the shroud bracket from the housing (Fig. 14).

(17) Remove the two ignition switch retaining screws and the switch from the key/lock cylinder housing (Fig. 14).

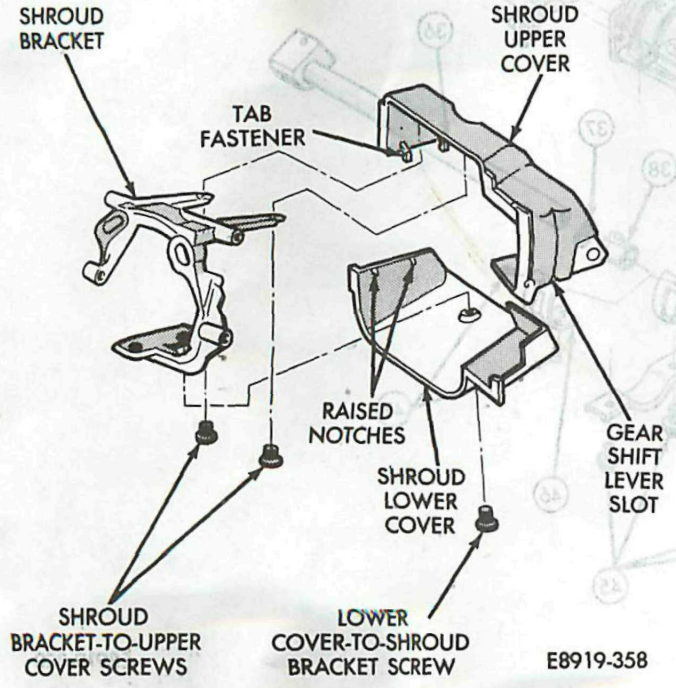


Fig. 11—Shroud Lower & Upper Covers

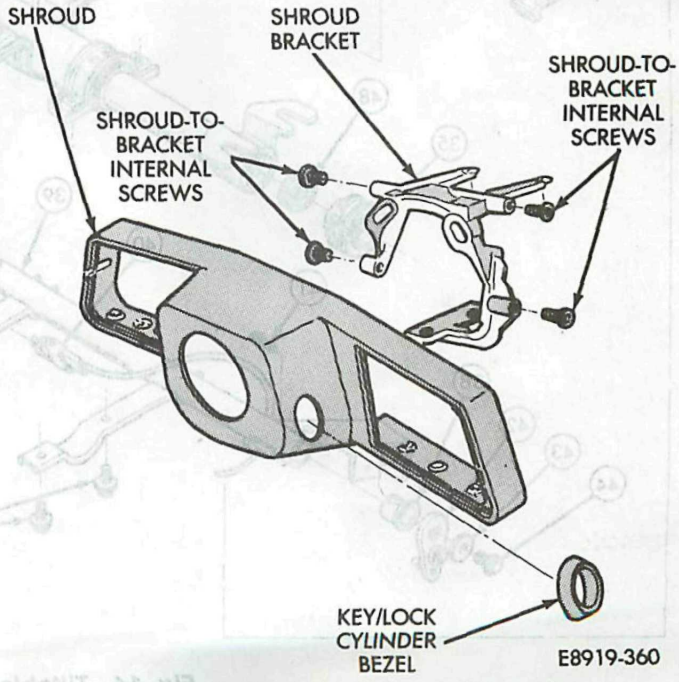


Fig. 13—Steering Column Shroud

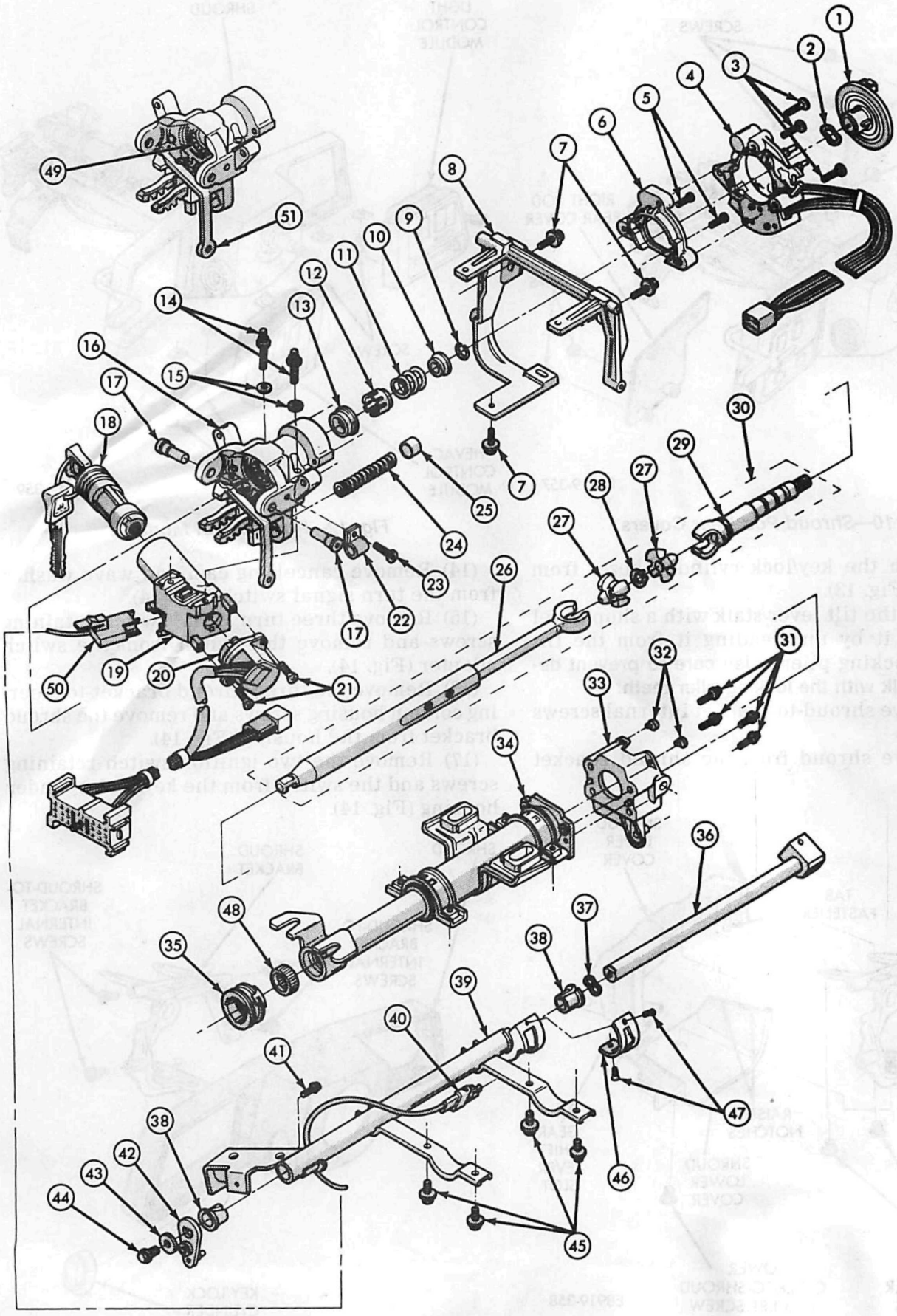


Fig. 14—Tiltable Steering Column

1. Turn Signal Cancelling Cam
2. Wave Washer
3. Turn Signal Switch Screws
4. Turn Signal Switch
5. Turn Signal Switch Adapter Screws
6. Turn Signal Switch Adapter
7. Shroud Bracket Screws
8. Shroud Bracket
9. Steering Shaft Retaining Ring
10. Spring Retainer
11. Upper Bearing Spring
12. Upper Bearing Inner Race Seat
13. Inner Race
14. Tamper-Proof Bolts
15. Tamper-Proof Bolt Washer (Hardened)
16. Steering Column Housing
17. Tilt Pivot Pins
18. Key/Lock Cylinder
19. Key/Lock Cylinder Housing
20. Ignition Switch
21. Ignition Switch Screws
22. Wire Clip
23. Wire Clip Screw
24. Tilt Spring
25. Tilt Spring Retainer
26. Lower Steering Shaft
27. Centering Spheres (Flex-Joint)
28. Flex-Joint Preload Spring
29. Upper Steering Shaft
30. Steering Shaft
31. Support Screw
32. Tilt Bumpers
33. Steering Column Support
34. Steering Column Jacket
35. Boot Seal Adapter
36. Gearshift Tube
37. Wave Washer
38. Gearshift Tube Bearing
39. Gearshift Housing
40. Park Lock Inhibitor Cable
41. Hex Washer Screw
42. Gearshift Lever
43. Flat Washer
44. Gearshift Lever Bolt
45. Gearshift Housing Bolts
46. Shift Lever Gate
47. Shift Lever Gate Screws
48. Steering Column Lower Bearing
49. Steering Column Upper Bearing
50. Shift Cable
51. Tilt Lever

(18) Turn the ignition key to the unmarked position. Press lock tab inward and remove cylinder from the key/lock cylinder housing (Fig. 14).

(19) Remove the two turn signal switch adapter screws and remove the adapter from the steering column housing (Fig. 14).

WARNING: THE STEERING SHAFT RETAINING RING AND UPPER BEARING SPRING RETAINER (FIG. 14) COMPRESS STRONG SPRING TENSION FROM THE UPPER BEARING SPRING. DO NOT ATTEMPT TO REMOVE THE RETAINING RING WITHOUT FIRST RELIEVING THE SPRING TENSION AGAINST IT BECAUSE, OTHERWISE, THE RETAINING RING COULD SUDDENLY DETACH FROM THE SHAFT WITH STRONG FORCE. USE AN APPROPRIATE COMPRESSOR TOOL AND SPRING COMPRESSOR ADAPTER TOOL 7100 (J35899) TO SAFELY REMOVE THE RETAINING RING.

(20) Remove the upper steering shaft retaining ring, the upper bearing spring retainer, and the upper bearing spring (Fig. 14) according to the following instructions:

(a) position Spring Compressor Adapter Tool 7100 (J35899) on the upper bearing spring retainer (Fig. 15).

CAUTION: Adapter Tool 7100 (J35899) must be positioned at a 45 degree angle from the key/lock cylinder housing (Fig. 16) to avoid damaging the steering column housing.

(b) thread the compressor tool shaft bore onto the steering column shaft hub (Fig. 15).

(c) tighten the compressor tool nut to compress the upper bearing spring retainer (Fig. 15).

(d) detach and remove the retaining ring (Fig. 16) from the upper steering shaft (discard the retaining ring, it is not reusable).

(e) loosen the compressor tool nut, unthread the compressor tool shaft and remove the compressor tool and the adapter tool.

(f) remove the upper bearing spring retainer and the spring (Fig. 14).

(21) Temporarily remove the tilt lever from the steering column housing (Fig. 14).

(22) The key/lock cylinder housing is attached to the steering column housing with two tamper-proof bolts and hardened washers (Fig. 17). The upper (Torx-head) part of the bolts is designed to shear from the lower part of the bolts when tightened during installation. The remaining lower part of the bolt must be center punched and drilled-out to remove the key/lock cylinder housing.

(23) Remove the key/lock cylinder housing from the steering column housing (Fig. 17) according to the following instructions:

(a) center punch a hole in the top of the tamper-proof bolts (Fig. 18)

(b) drill out the bolt heads with a 6 mm (1/4 in) diameter drill bit (Fig. 18)

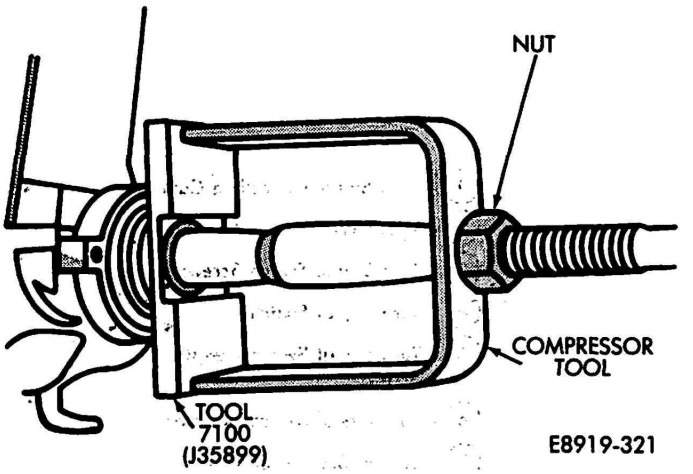


Fig. 15—Compressor & Adapter Tools

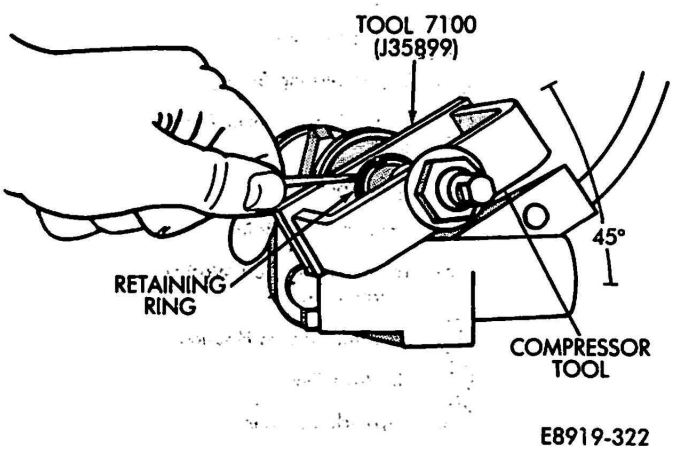


Fig. 16—Steering Shaft Retaining Ring Removal

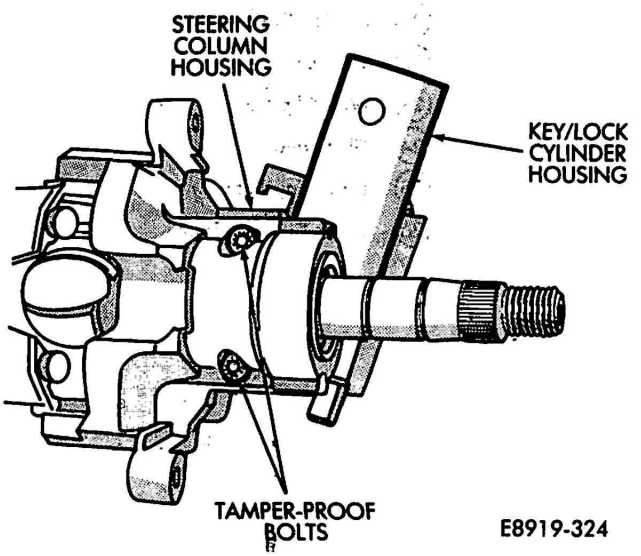


Fig. 17—Key/Lock Cylinder Housing

(c) continue drilling until the drill bit contacts the hardened washers (Fig. 18)

(d) The hardened washers prevent the drill bit from damaging the steering column housing

(e) remove the lock cylinder housing from the steering column housing (Fig. 14, Fig. 19)

(f) remove the drilled-out bolts from the key/lock cylinder housing with a pair of pliers (Fig. 19).

(24) Install the tilt lever and place the steering column housing in the highest upward tilted position.

WARNING: THE FOLLOWING STEP INVOLVES REMOVAL OF THE TILT SPRING, WHICH EXERTS STRONG TENSION AGAINST THE TILT-SPRING RETAINER (FIG. 20). EXERCISE EXTREME CARE WHEN REMOVING THE TILT-SPRING RETAINER. THE PHILLIPS SCREWDRIVER TIP SHOULD BE JUST LARGE ENOUGH TO SNUGLY FIT INTO THE RETAINER CROSS-SHAPED RECESS.

(25) Remove the tilt-spring retainer with a large Phillips screwdriver. Insert the screwdriver tip in the retainer cross-shaped recess. Press the retainer inward and turn it clockwise to unlock and remove the retainer and spring (Fig. 20).

(26) Place the steering column housing in the center (non-tilted) position.

(27) Remove the steering column housing tilt pivot pins with Pivot Pin Removal Tool 7101 (J21854-1). Thread the tool bolt into each pin. Tighten the tool nut to force each pivot pin from the housing (Fig. 21).

(28) Move the tilt lever forward to disengage the steering column housing lock shoes from the steering column support. Move the housing away from the steering column support and off the upper steering shaft (Fig. 14, Fig. 22).

CAUTION: Do not strike the steering shafts to remove them because the steering column shear pins could be damaged.

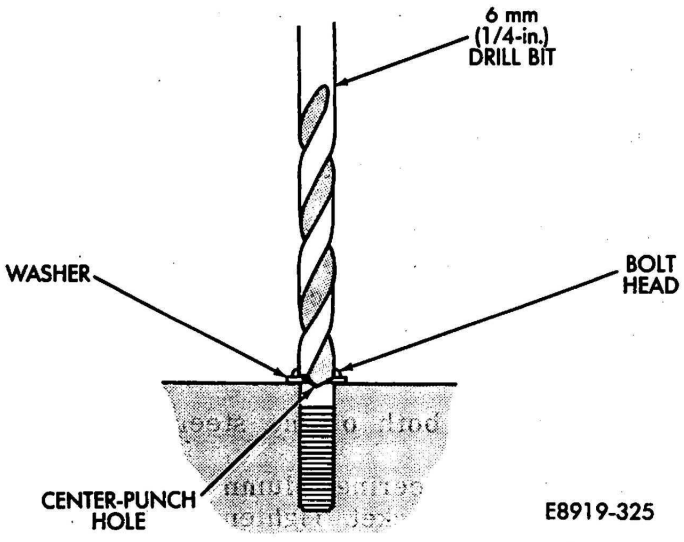


Fig. 18—Drilling Key/Lock Cylinder Housing Bolt

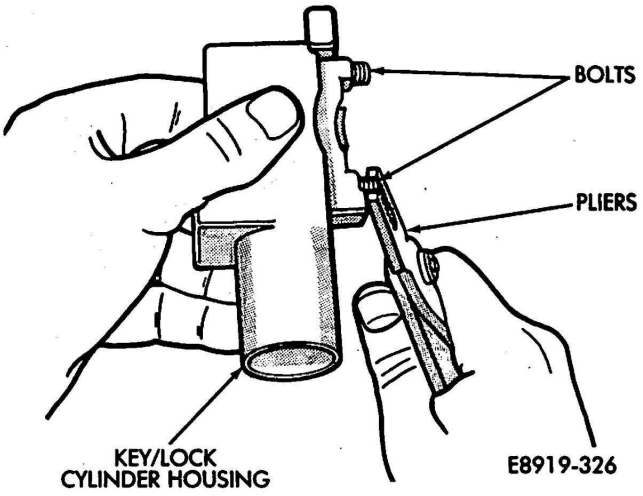


Fig. 19—Bolt Removal

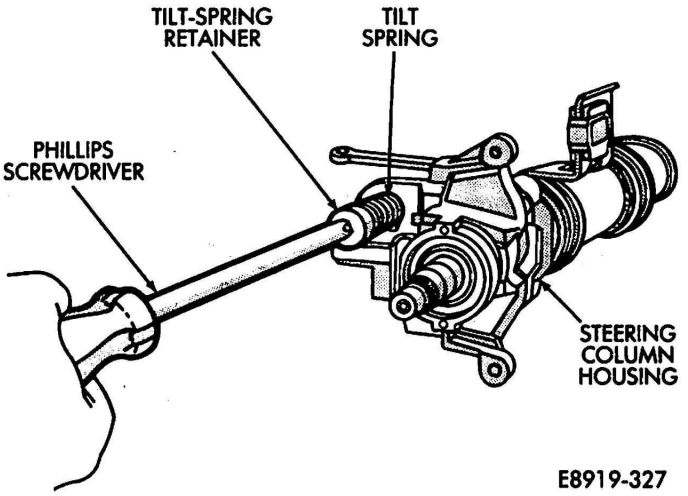


Fig. 20—Tilt Spring Removal

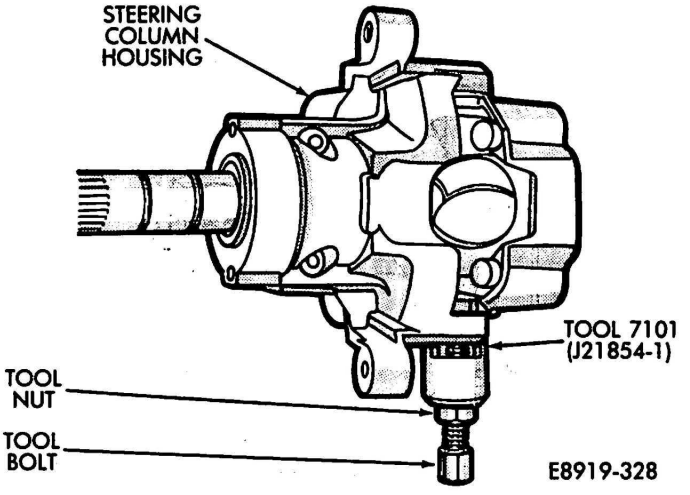


Fig. 21—Tilt Pivot Pin Removal

(29) Pull the steering shafts out of the steering column support and the jacket (Fig. 23).

(30) Remove the four steering column support Torx-head screws and remove the support from

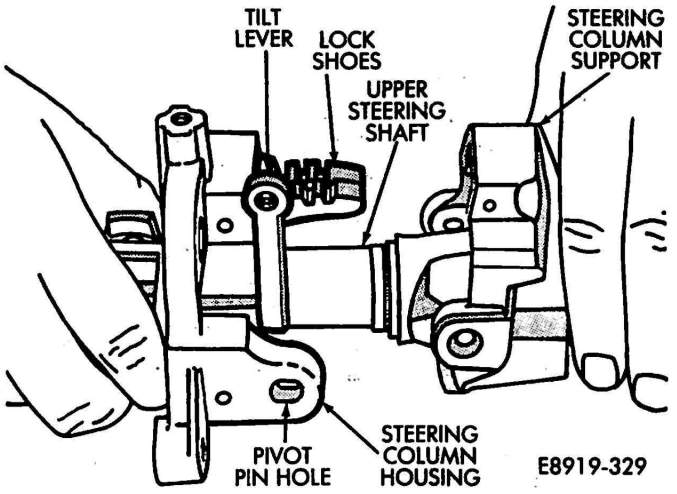


Fig. 22—Steering Column Housing Removal

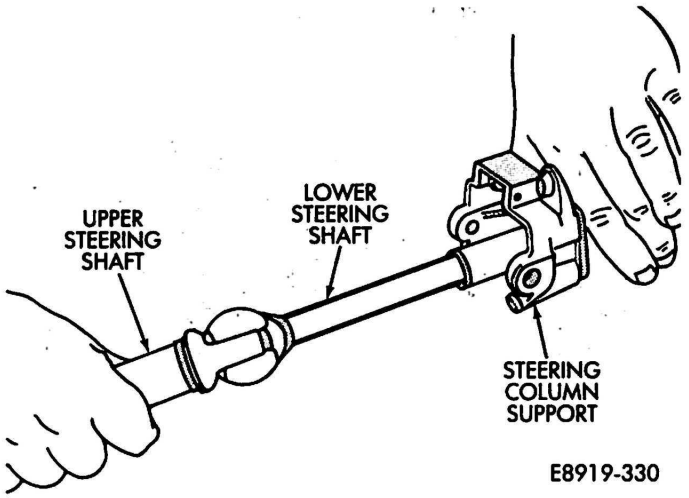


Fig. 23—Steering Shaft Removal

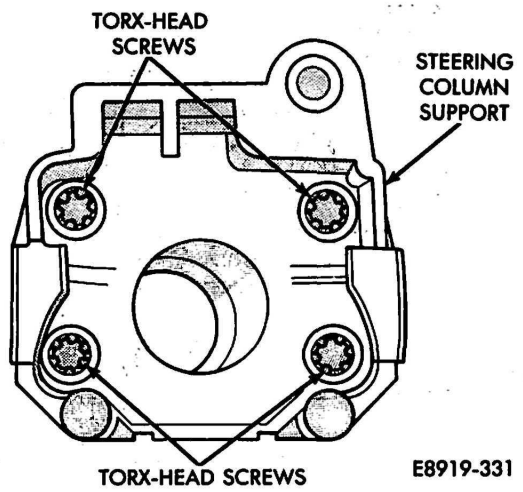


Fig. 24—Steering Column Support Removal

the steering column jacket (Fig. 24).

(31) Separate the steering shafts. Pivot the upper and lower shafts to a 90° angle and separate them at the flexible joint (Fig. 25).

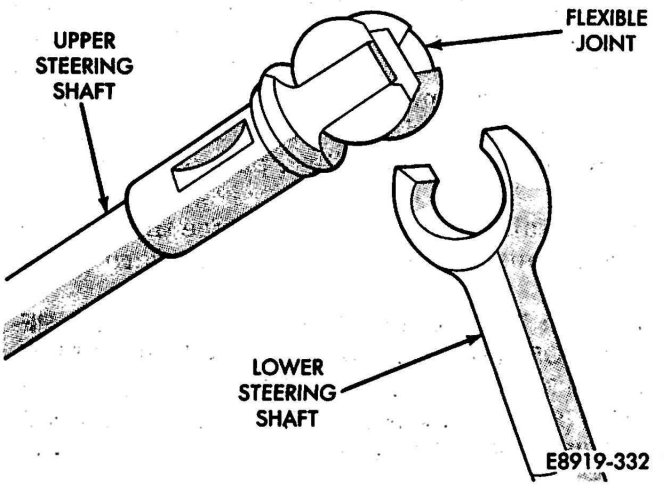


Fig. 25—Steering Shaft Separation

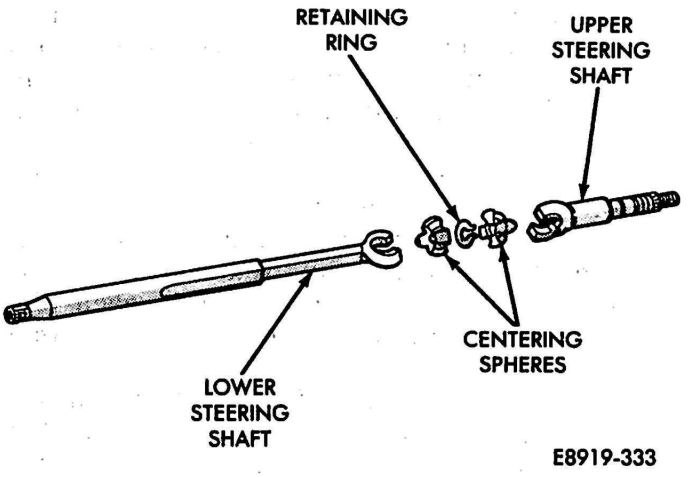


Fig. 26—Connecting Upper & Lower Steering Shafts

(32) Inspect each of the steering column components for wear and damage. Replace the components as necessary.

The steering column bearings are not separately available. If the bearing in the steering column housing or the bearing in the steering column jacket is worn or damaged, replace the housing or the jacket, as applicable. A replacement bearing is included as part of a replacement housing or jacket.

(33) If the steering column was removed as a result of collision damage, inspect the column as instructed in the steering column inspection procedure (located within this Group).

Assembly

(1) Lubricate both of the steering column bearings.

(2) Install the steering column support on the steering column jacket. Tighten the Torx-head screws securely (Fig. 24).

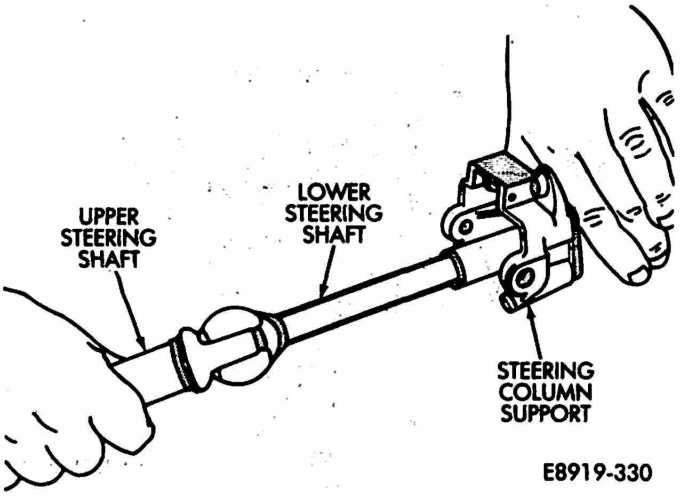


Fig. 27—Steering Shaft Installation

(3) Attach a centering sphere to each steering shaft. Connect the upper and lower shafts. Install the retaining ring to retain the two spheres together (Fig. 26).

(4) Insert the connected steering shafts through the steering column support and into the steering column jacket (Fig. 27).

(5) Position the steering column housing over the steering shaft and mate it with the steering column support (Fig. 28).

(6) Align the tilt pivot pin holes in the housing and in the support (Fig. 28).

It is necessary to lower the steering column housing lock shoes with the tilt lever to align the tilt pivot pin holes.

(7) Insert the tilt pivot pins in the holes in the housing and in the support.

(8) Seat the tilt pivot pins with a punch and hammer (Fig. 29).

(9) Stake each tilt pivot pin at two places with a punch and a hammer (Fig. 30).

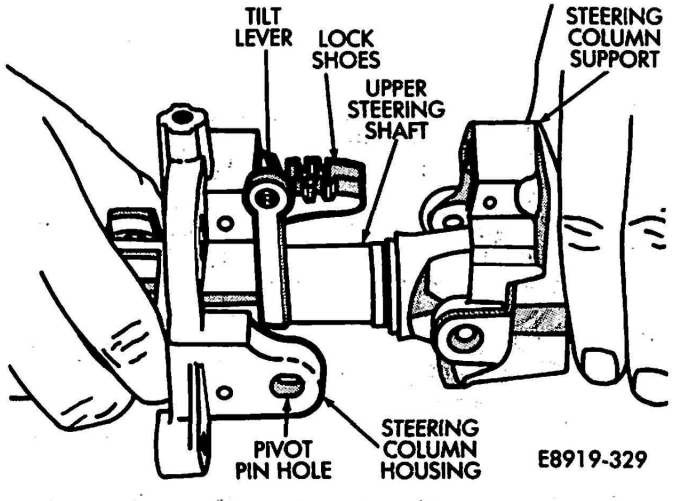


Fig. 28—Steering Column Housing Installation

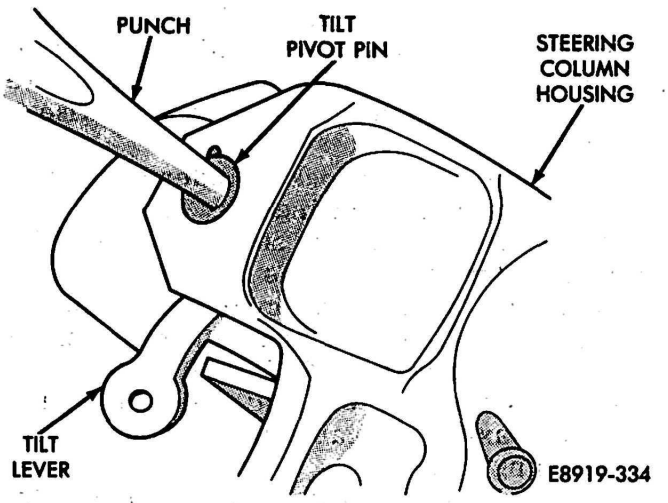


Fig. 29—Tilt Pivot Pin Installation

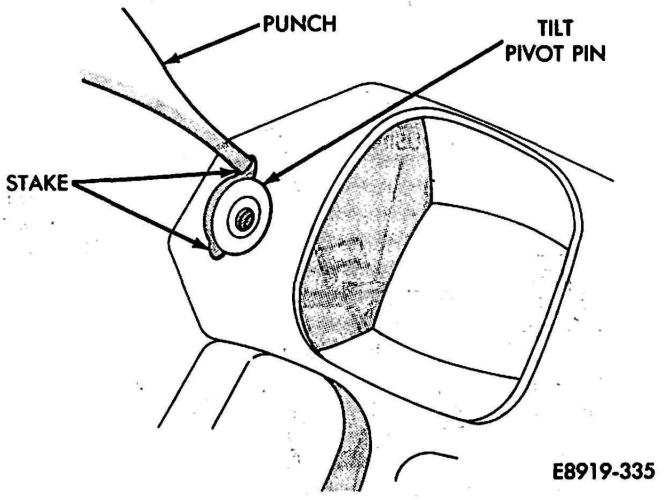


Fig. 30—Staked Tilt Pivot Pin

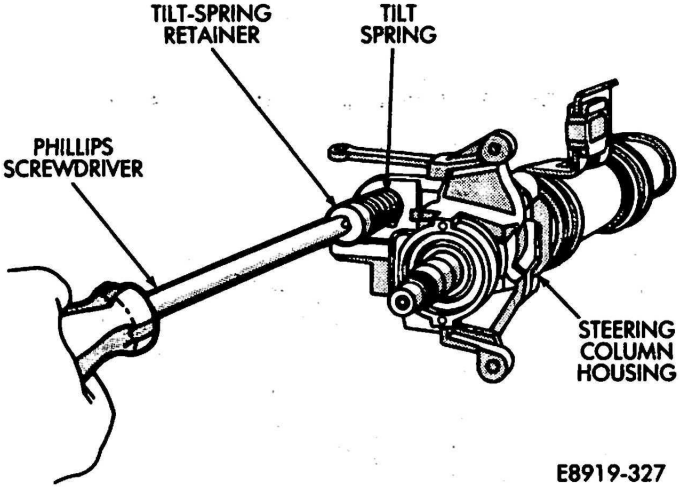


Fig. 31—Tilt Spring Installation

(10) Insert the tilt spring in the steering column housing and position the spring retainer over the end of the spring.

(11) Install the tilt spring and the retainer in the steering column housing with a large Phillips screwdriver (Fig. 31). Force the spring retainer inward and turn it counterclockwise to lock it.

(12) Position the key/lock cylinder housing on the steering column housing (Fig. 32).

CAUTION: Do not substitute any other type of fastener for the tamper-proof bolts (Fig. 33).

(13) Attach the key/lock cylinder housing to the steering column housing with replacement tamper-proof bolts (Fig. 32, Fig. 33).

(14) Press the lock tab and install the automatic transaxle shift cable in the steering column housing (Fig. 34).

(15) Install the upper bearing spring, the upper bearing spring retainer and the steering shaft retaining ring according to the following instructions:

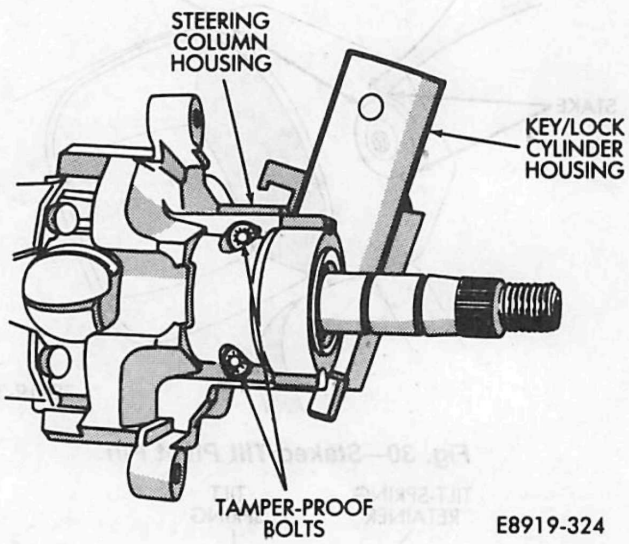


Fig. 32—Key/Lock Cylinder Housing

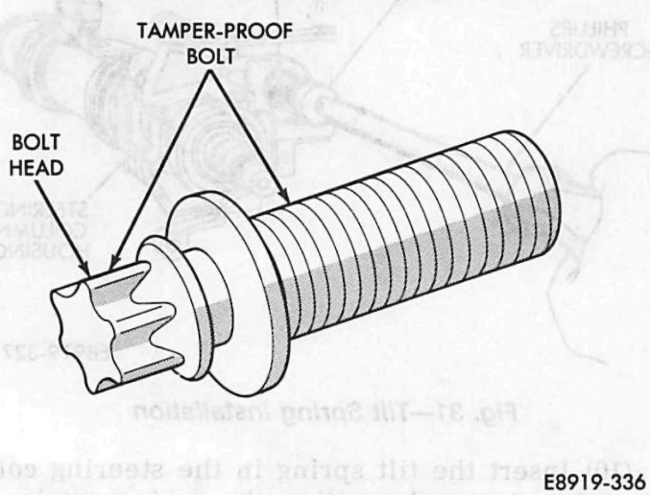


Fig. 33—Tamper-Proof Bolt

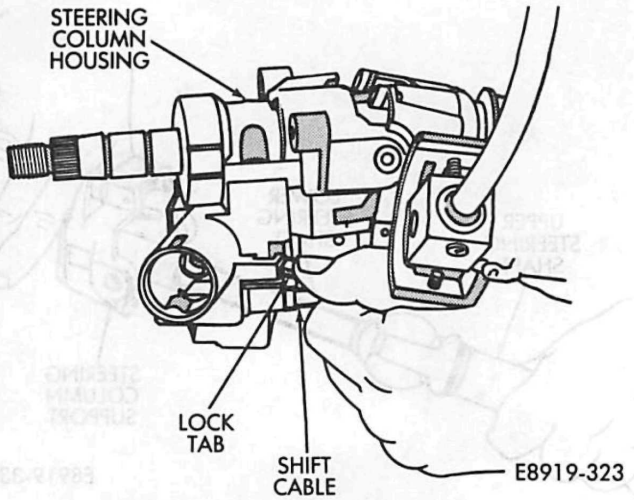


Fig. 34—Shift Cable Installation

(a) position the upper bearing spring and the spring retainer over the upper steering shaft and against the upper bearing (Fig. 35)

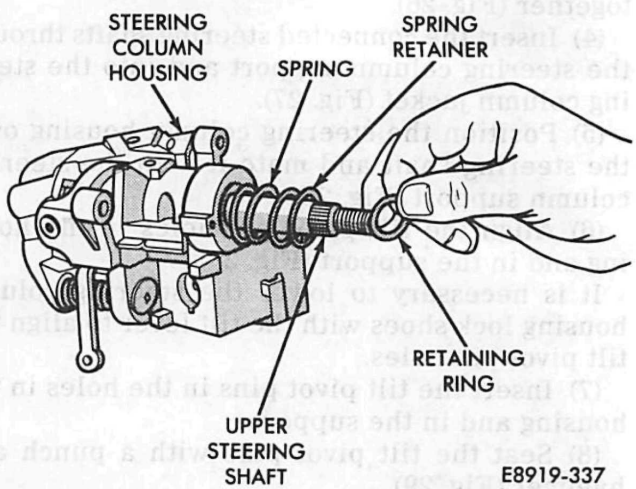


Fig. 35—Spring, Spring Retainer & Retaining Ring

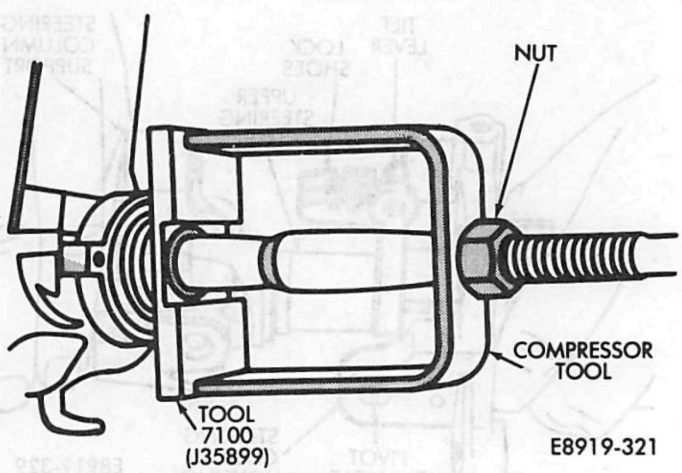


Fig. 36—Compressor Tool & Adapter Tool 7100

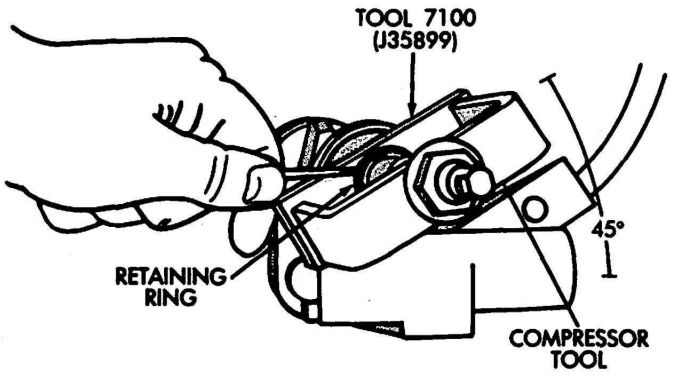


Fig. 37—Steering Shaft Retaining Ring Installation

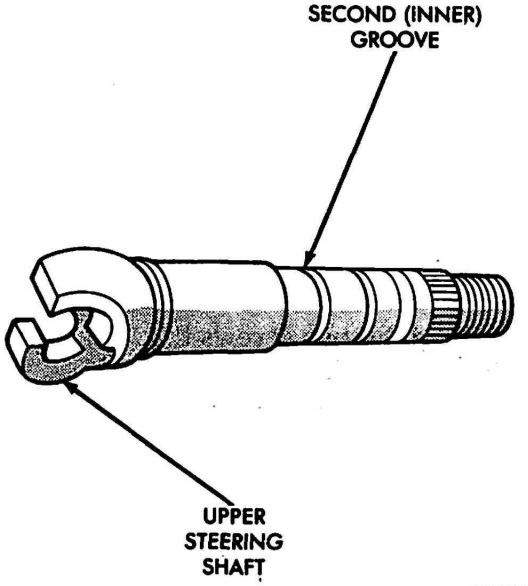


Fig. 38—Upper Steering Shaft

(b) position Spring Compressor Adapter Tool 7100 (J35899) on the upper bearing spring retainer (Fig. 36)

CAUTION: Adapter Tool 7100 (J35899) must be positioned at a 45 degree angle from the key/lock cylinder housing (Fig. 37) to avoid damaging the steering column housing.

(c) thread the shaft bore on an appropriate compressor tool onto the steering column shaft hub (Fig. 36)

(d) tighten compressor tool nut (Fig. 36) to compress upper bearing spring retainer and allow retaining ring (Fig. 37) to be inserted in the second (inner) shaft groove (Fig. 38)

(e) insert the retaining ring in the second (inner) steering shaft groove (Fig. 38)

(f) loosen the compressor tool nut, unthread the compressor tool shaft from the steering shaft hub and remove the compressor tool and the adapter tool.

(16) Position the ignition switch on the key/lock cylinder housing and install the two retaining screws.

(17) Position the shroud bracket on the steering column housing and install the three shroud bracket-to-housing screws.

(18) Position the turn signal switch adapter on the steering column housing and install the two adapter-to-housing screws.

(19) Position the turn signal switch on the switch adapter and install the three retaining screws.

(20) Install the wave washer and the cancelling cam on the turn signal switch.

(21) Turn the ignition key to the unmarked position and install the key/lock cylinder in the cylinder housing.

(22) Position the shroud on the shroud bracket (Fig. 39).

(23) Install the shroud-to-bracket internal screws (Fig. 39).

(24) Attach the key/lock cylinder bezel to the shroud (Fig. 39).

(25) Cover the tilt lever stalk with a shop towel and install it by threading it into the tilt lever with locking pliers. **Use care to prevent defacing the stalk with the locking plier teeth.**

(26) Position the control modules in the shroud and install the shroud-to-control module screws (Fig. 39).

(27) Slide the shroud upper cover over the gearshift lever and position it adjacent to the shroud and on the shroud bracket (Fig. 39).

(28) Install the two shroud bracket-to-upper cover screws (Fig. 39).

(29) Carefully mate the lower cover with the upper cover by attaching the upper cover tab fasteners to the lower cover notches. Install the lower cover-to-shroud bracket screw (Fig. 39).

(30) Position the rear covers on the shroud pods (Fig. 48).

(31) Install the three screws that attach the rear cover to the left shroud pod (Fig. 39).

(32) Install the two screws that attach the rear cover to the right shroud pod (Fig. 39).

(33) Install the steering column in the vehicle. If necessary, refer to the installation procedure (located within this Group) for detailed instructions.

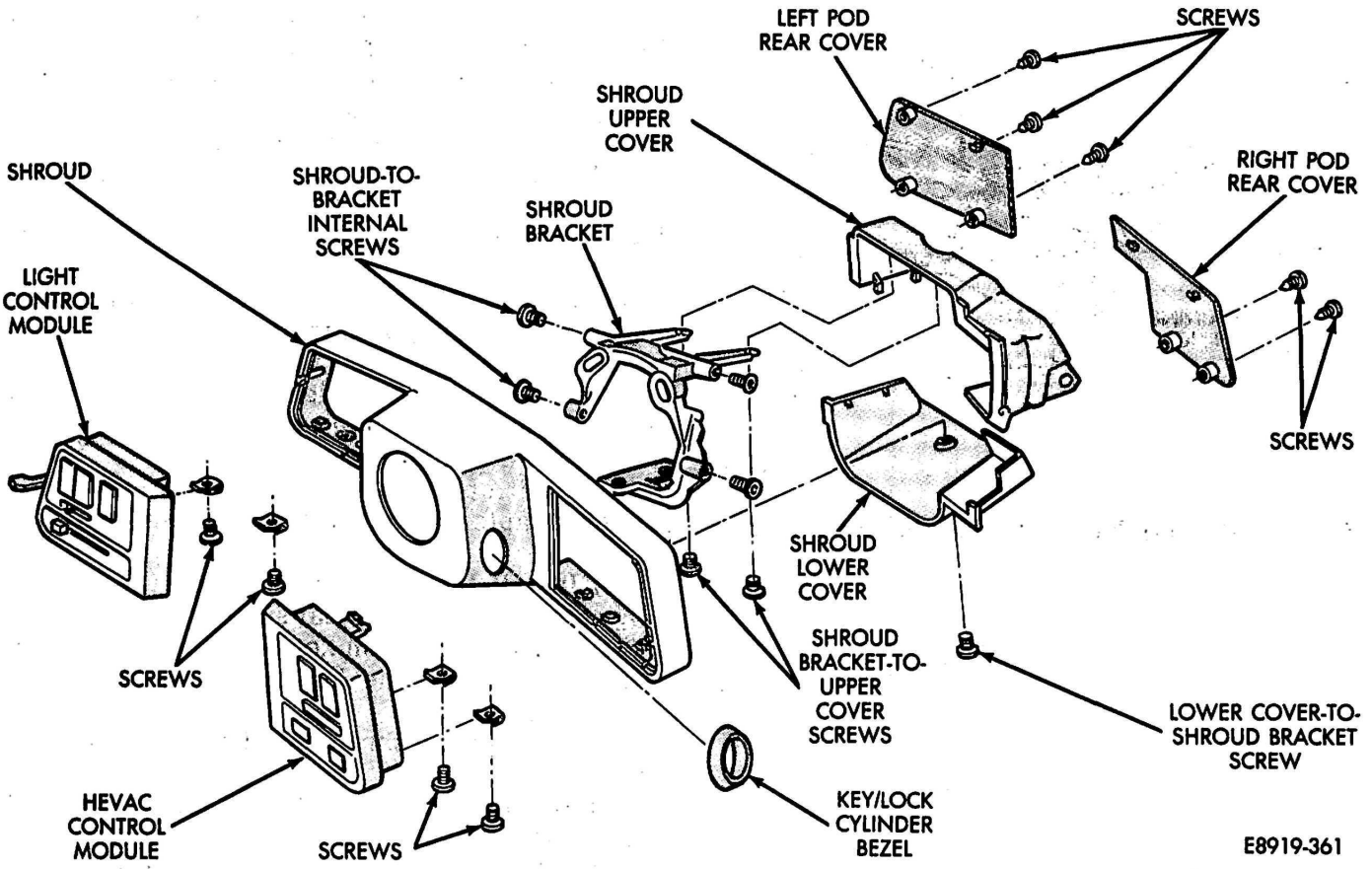


Fig. 39—Steering Column Shroud

(34) Install the steering wheel. If necessary, refer to the installation procedure (located within this Group) for detailed instructions.

(35) Connect the battery negative cable.

Non-Tiltable (fixed) Steering Column—Overhaul

Disassembly

CAUTION: When a steering column is removed from a vehicle for service, use extreme care when handling it. Do not drop it or allow either of its ends to impact any object. A severe impact to either end could cause the jacket, the steering shaft, and/or the shear pins to collapse. If steering column damage is suspected, refer to the steering column inspection procedure (located within this Group) for detailed information.

(1) Disconnect the battery negative cable.

(2) Remove the steering wheel. If necessary, refer to the removal procedure (located within this Group) for detailed instructions.

(3) Remove the steering column from the vehicle (Fig. 40). If necessary, refer to the removal procedure (located within this Group) for detailed instructions.

(4) Remove the three screws that attach the rear cover to the left shroud pod (Fig. 41).

(5) Remove the two screws that attach the rear cover to the right shroud pod (Fig. 41).

(6) Remove the rear covers from the shroud pods (Fig. 41).

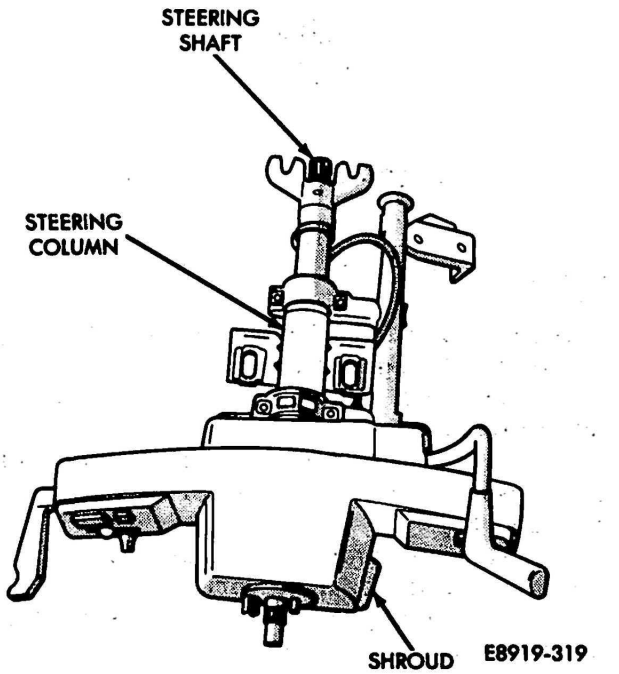


Fig. 40—Steering Column

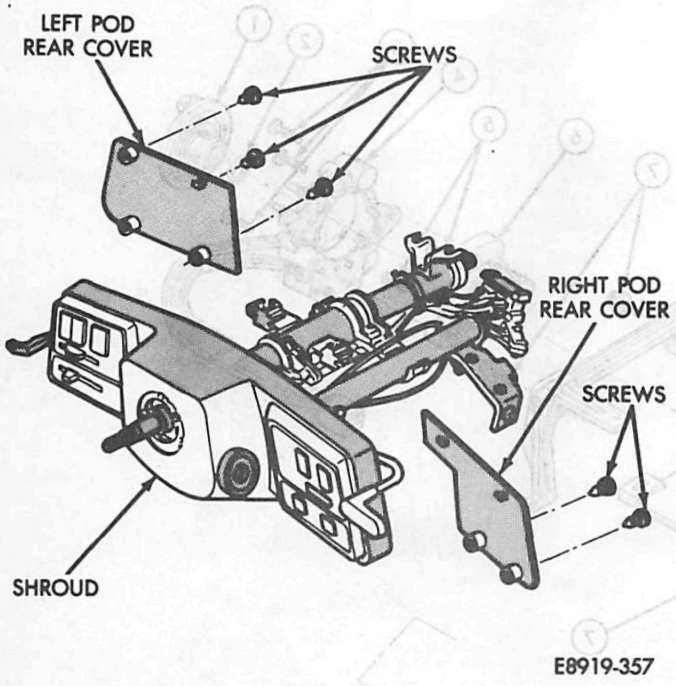


Fig. 41—Shroud Pod Rear Covers

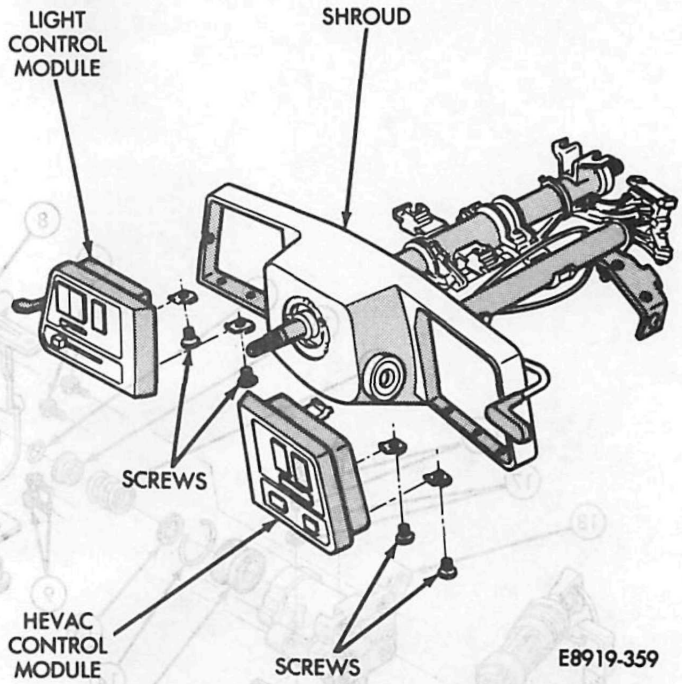


Fig. 43—Pod Control Modules

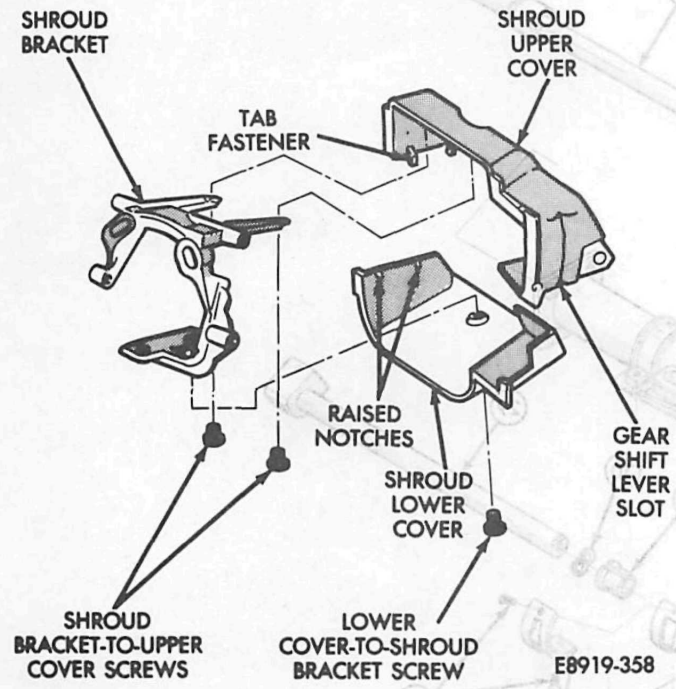


Fig. 42—Shroud Lower & Upper Covers

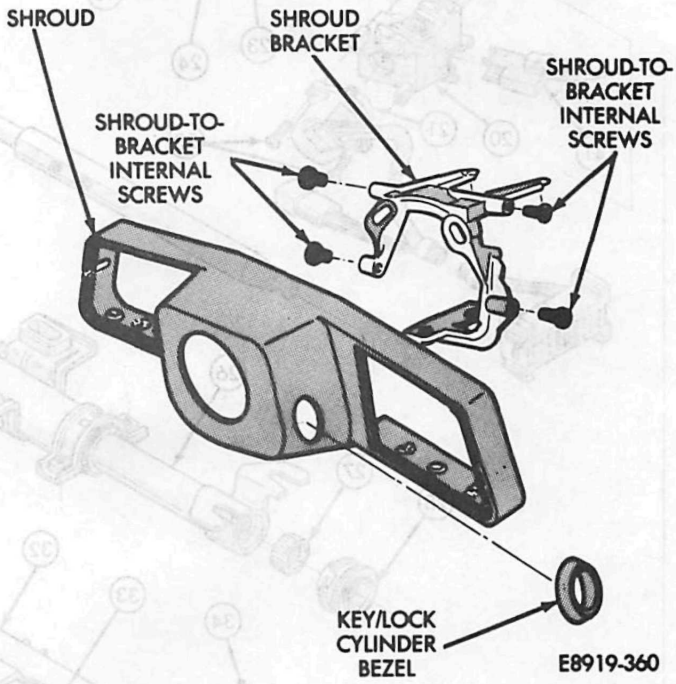


Fig. 44—Steering Column Shroud

(7) Remove the lower cover-to-shroud bracket screw and carefully separate the lower cover from the upper cover by detaching the upper cover tab fasteners from the lower cover notches (Fig. 42).

(8) Remove the two shroud bracket-to-upper cover screws and remove the shroud upper cover (Fig. 42).

(9) Slide the shroud upper cover off the gear-shift lever.

(10) Remove the shroud-to-control module screws and remove the control modules from the pods (Fig. 43). This will allow access to the four shroud-to-bracket internal screws.

(11) Detach the key/lock cylinder bezel from the shroud (Fig. 44).

(12) Remove shroud-to-bracket internal screws (Fig. 44).

(13) Remove shroud from the shroud bracket (Fig. 44).

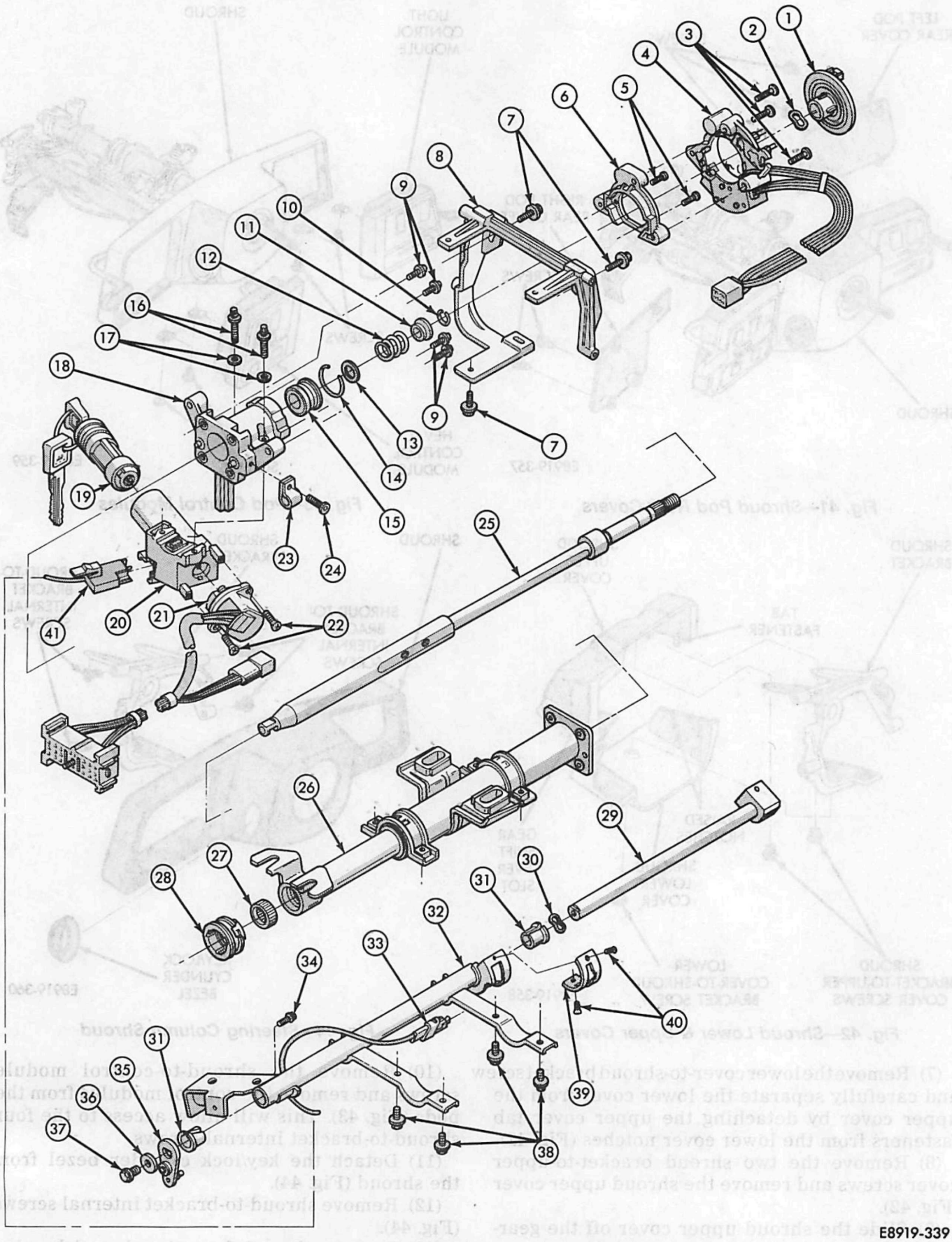


Fig. 45—Non-Tiltable (Fixed) Steering Column

1. Turn Signal Cancelling Cam
2. Wave Washer
3. Turn Signal Switch Screws
4. Turn Signal Switch
5. Adapter Screws
6. Turn Signal Adapter
7. Shroud Bracket Screws
8. Shroud Bracket
9. Housing Screws
10. Steering Shaft Retaining Ring
11. Retainer Spring
12. Bearing Spring
13. Thrust Washer
14. Bearing Retaining Ring
15. Upper Bearing
16. Tamper-Proof Bolt
17. Tamper-Proof Bolt Washer
18. Column Housing
19. Key/Lock Cylinder
20. Key/Lock Cylinder Housing
21. Ignition Switch
22. Ignition Switch Screws
23. Wire Retainer
24. Retainer Screw
25. Steering Shaft
26. Column Jacket
27. Lower Bearing
28. Boot Seal Adapter
29. Gearshift Tube
30. Wave Washer
31. Tube Bearings
32. Shift Tube Housing
33. Park Lock Inhibitor Cable
34. Hex Washer Screw
35. Gearshift Lever
36. Flat Washer
37. Shift Lever Bolt
38. Housing Bracket Bolts
39. Shift Lever Gate
40. Gate Screws
41. Shift Cable

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(14) Remove cancelling cam and wave washer from turn signal switch (Fig. 45).

(15) Remove three turn signal switch retaining screws and remove the switch from the switch adapter (Fig. 45).

(16) Remove the three shroud bracket-to-steering column housing screws and remove the shroud bracket from the housing (Fig. 45).

(17) Remove the two ignition switch retaining screws and the switch from the key/lock cylinder housing (Fig. 45).

(18) Turn the ignition key to the unmarked position. Press the lock tab inward and remove the key/lock cylinder from the cylinder housing (Fig. 45).

(19) Remove the two turn signal switch adapter screws and remove the adapter from the steering column housing (Fig. 45)

WARNING: THE STEERING SHAFT RETAINING RING AND UPPER BEARING SPRING RETAINER (FIG. 45) COMPRESS STRONG SPRING TENSION FROM THE UPPER BEARING SPRING. DO NOT ATTEMPT TO REMOVE THE RETAINING RING WITHOUT FIRST RELIEVING THE SPRING TENSION AGAINST IT BECAUSE, OTHERWISE, THE RETAINING RING COULD SUDDENLY DETACH FROM THE SHAFT WITH STRONG FORCE. USE AN APPROPRIATE COMPRESSOR TOOL AND SPRING COMPRESSOR ADAPTER TOOL 7100 (J35899) TO SAFELY REMOVE THE RETAINING RING.

(20) Remove the upper steering shaft retaining ring, the upper bearing spring retainer, the upper bearing spring and the thrust washer (Fig. 45) according to the following instructions:

(a) position Spring Compressor Adapter Tool 7100 (J35899) on the upper bearing spring retainer (Fig. 46)

CAUTION: Adapter Tool 7100 (J35899) must be positioned at a 45 degree angle from the key/lock cylinder housing (Fig. 47) to avoid damaging the steering column housing.

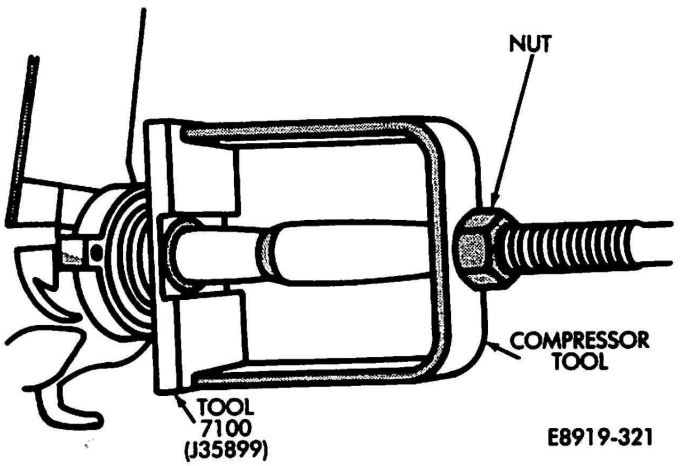


Fig. 46—Compressor & Adapter Tools

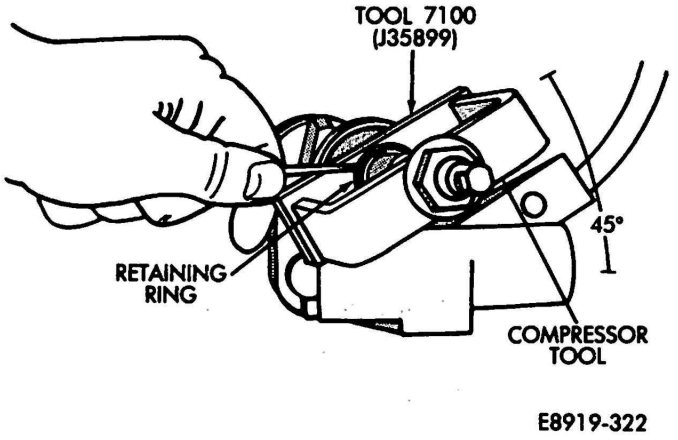


Fig. 47—Steering Shaft Retaining Ring Removal

(b) thread the compressor tool shaft bore onto the steering column shaft hub (Fig. 46)

(c) tighten the compressor tool nut to compress the upper bearing spring retainer (Fig. 46)

(d) detach and remove the retaining ring (Fig. 47) from the upper steering shaft (discard the retaining ring, it is not reusable)

(e) loosen the compressor tool nut, unthread the compressor tool shaft from the steering shaft hub and remove the compressor tool and adapter tool

(f) remove the upper bearing spring retainer, the spring and the thrust washer (Fig. 45).

(21) Remove the automatic transaxle shift from the steering column housing by depressing the lock tab (Fig. 48).

(22) Remove the key/lock clyinder housing from the steering column housing (Fig. 45, Fig. 49) according to the following instructions:

(a) center punch a hole in the top of the tamper-proof bolts (Fig. 50)

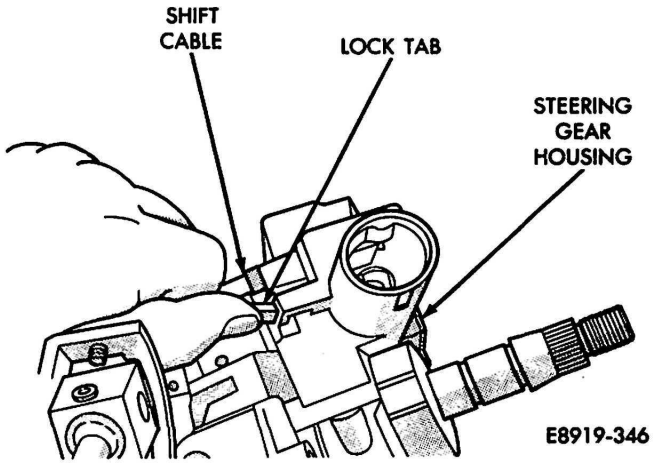


Fig. 48—Shift Cable Removal

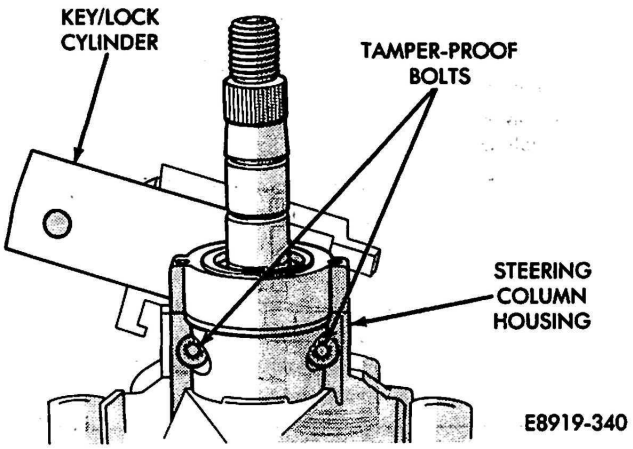


Fig. 49—Key/Lock Cylinder Housing

(b) drill-out the bolt heads with a 6 mm (1/4 in.) diameter drill bit (Fig. 50)

(c) continue drilling until the drill bit contacts the hardened washers (Fig. 50)

The hardened washers prevent the drill bit from damaging the steering column housing.

The key/lock cylinder housing is attached to the steering column housing with two tamper-proof bolts and hardened washers (Fig. 45, Fig. 46). The upper (Torx-head) part of the bolts is designed to "shear-off" from the lower part of the bolts when tightened during installation. The remaining, lower part of the bolt must be center-punched and drilled-out to remove the key/lock cylinder housing.

(d) remove the lock cylinder housing from the steering column housing

(e) remove the drilled-out bolts from the key/lock cylinder housing with a pair of pliers (Fig. 51).

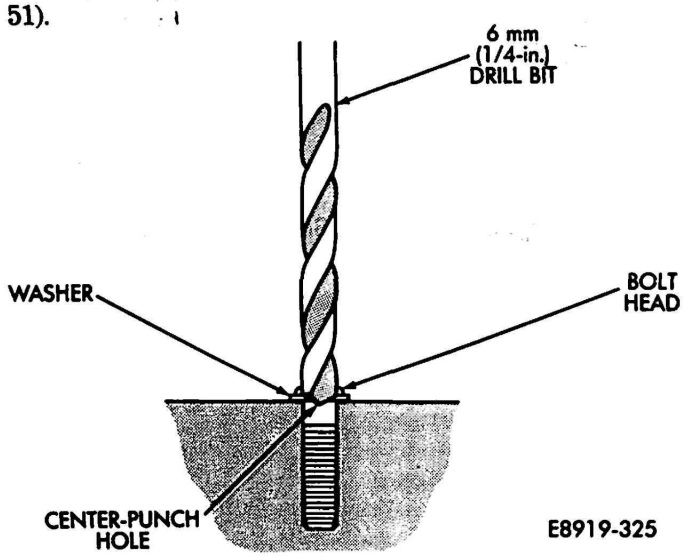


Fig. 50—Drilling Key/Lock Cylinder Housing Bolt

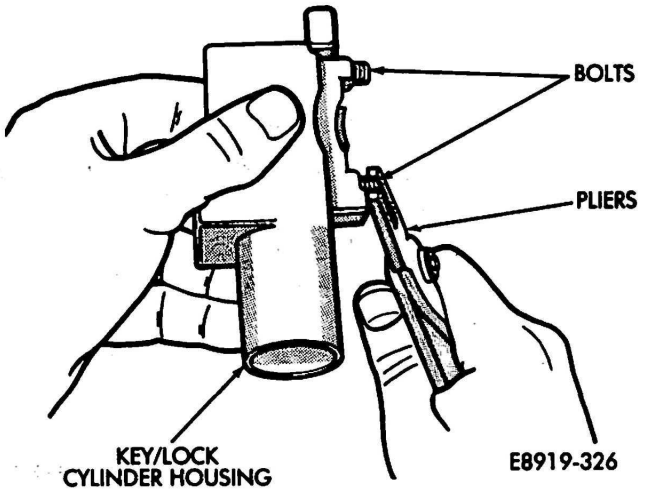


Fig. 51—Bolt Removal

(23) Remove the four steering column housing Torx-head screws and remove the housing from the steering column jacket (Fig. 52).

CAUTION: Do not strike the steering shaft to remove it because the steering column shear pins could be damaged.

(24) Remove the steering shaft by pulling it out of the steering column jacket (Fig. 53).

(25) Remove the upper bearing from the steering column housing (Fig. 54) according to the following instructions:

(a) remove the upper bearing retaining ring from the groove in the steering column housing bore (Fig. 54) and

If the bearing in the steering column jacket is worn or damaged, replace the jacket. A replacement bearing is included as part of a replacement jacket.

(b) force the upper bearing out of the housing with two appropriately sized socket wrenches (or lengths of steel tube) used as a bearing driver tool and a receiver tool (Fig. 55).

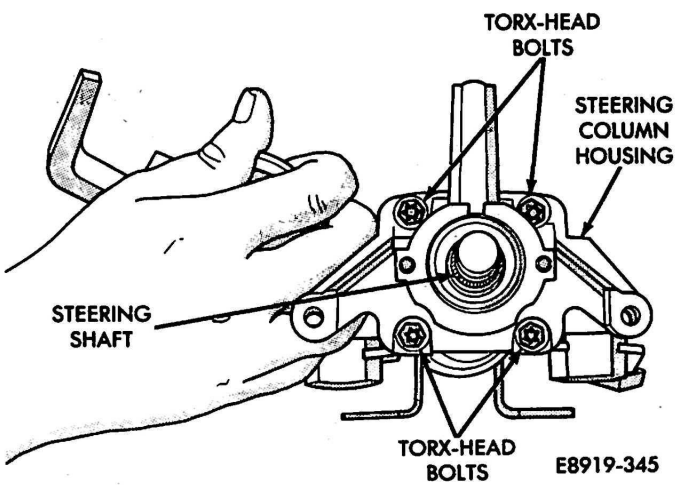


Fig. 52—Steering Column Housing Removal

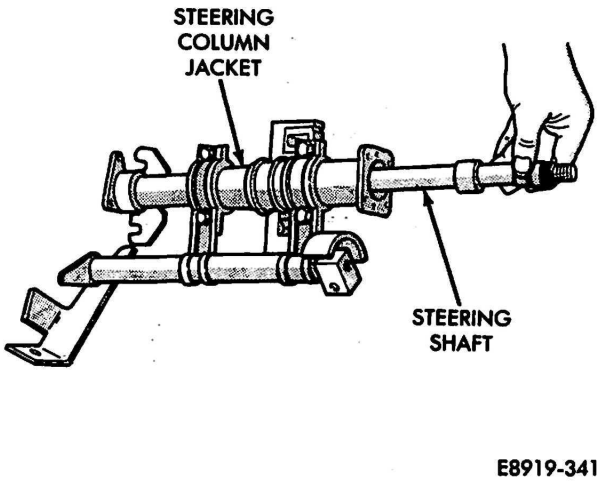


Fig. 53—Steering Shaft Removal

(26) Inspect each of the steering column components for wear and damage. Replace the components as necessary.

(27) If the steering column was removed as a result of collision damage, inspect the column as instructed in the steering column inspection procedure (located within this Group).

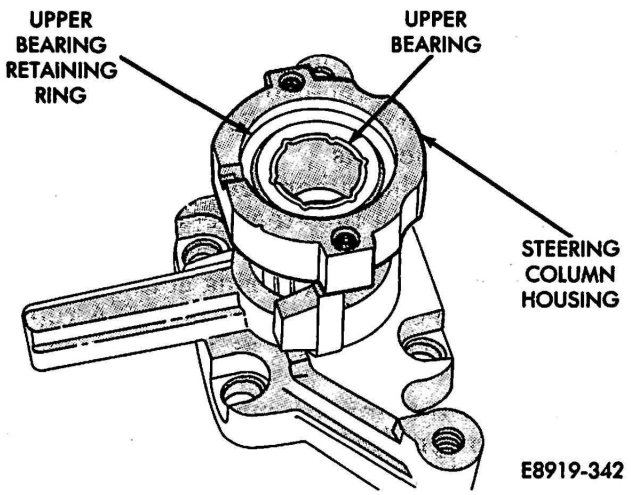


Fig. 54—Column Housing Retaining Ring & Bearing

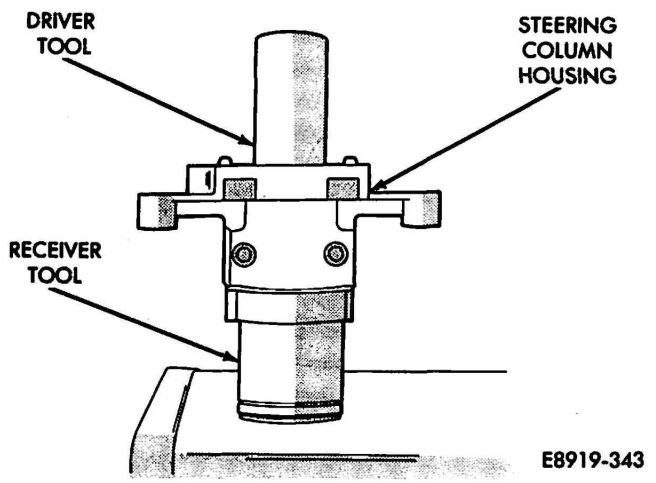


Fig. 55—Upper Bearing Removal

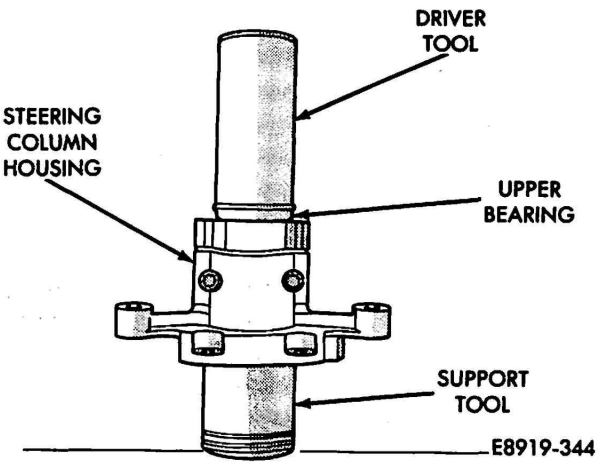


Fig. 56—Upper Bearing Installation

Assembly

(1) Force the replacement upper bearing into the steering column housing with two appropriately sized socket wrenches (or lengths of steel tube) used as a driver tool and housing support tool (Fig. 56).

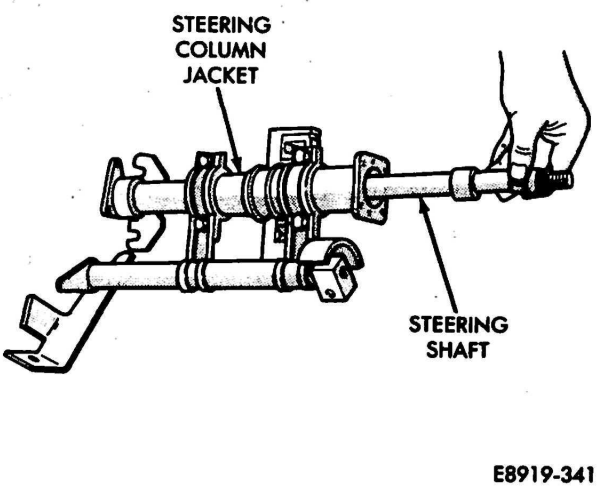


Fig. 57—Steering Shaft Installation

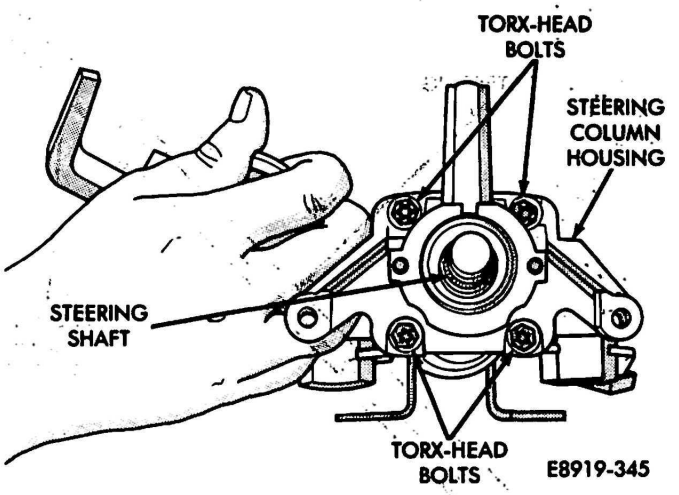


Fig. 58—Steering Column Housing Installation

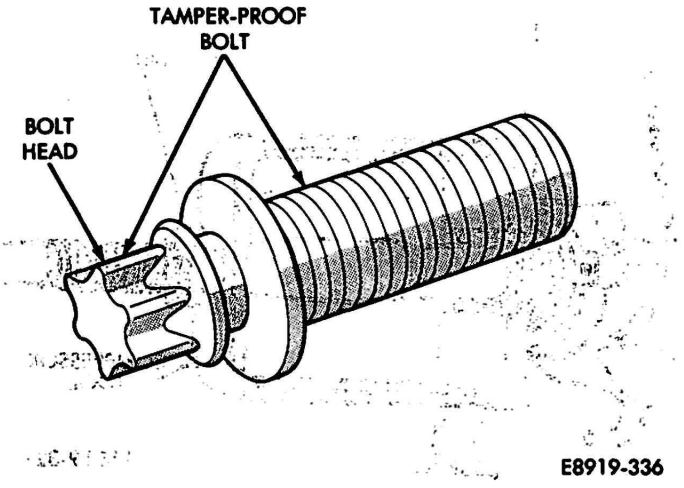


Fig. 60—Tamper-Proof Bolt

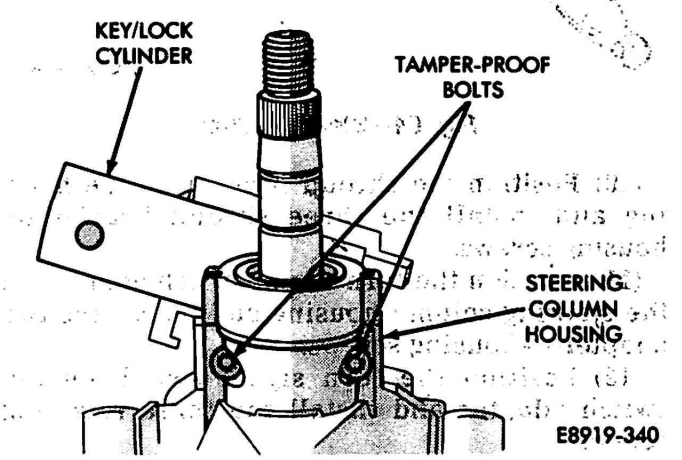


Fig. 59—Key/Lock Cylinder Housing Installation

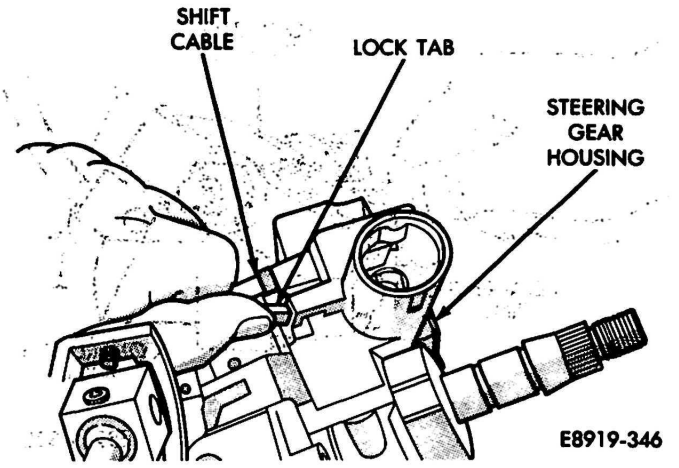


Fig. 61—Shift Cable Installation

(2) Lubricate both of the steering column bearings.

(3) Insert the steering shaft into the steering column jacket (Fig. 57).

(4) Position the steering column housing over the steering shaft and on the steering column jacket. Install and tighten the Torx-head screws securely (Fig. 58).

(5) Position the key/lock cylinder housing on the steering column housing (Fig. 59).

CAUTION: Do not substitute any other type of fastener for the tamper-proof bolts (Fig. 60).

(6) Attach the key/lock cylinder housing to the steering column housing with replacement tamper-proof bolts (Fig. 59, Fig. 60).

(7) Press the lock tab and install the automatic transaxles shift cable in the steering column housing (Fig. 61).

(8) Install the thrust washer, the upper bearing spring, the upper bearing spring retainer and the steering shaft retaining ring (Fig. 45) according to the following instructions:

(a) position the thrust washer, the upper bearing spring and the spring retainer over the steering shaft and against the upper bearing

(b) position Spring Compressor Adapter Tool 7100 (J35899) on the upper bearing spring retainer (Fig. 62).

CAUTION: Adapter Tool 7100 (J35899) must be positioned at a 45 degree angle from the key/lock cylinder housing (Fig. 63) to avoid damaging the steering column housing.

(c) thread the shaft bore of an appropriate compressor tool onto the steering column shaft hub (Fig. 62)

(d) tighten the compressor tool nut to compress the upper bearing spring retainer and allow the retaining ring to be inserted in the second (inner) shaft groove. (Figs. 63 and 64).

The retaining ring must be inserted in the second (inner) groove of the steering shaft (Fig. 64).

(e) insert the retaining ring in the second (inner) steering shaft groove. (Figs. 63 and 64).

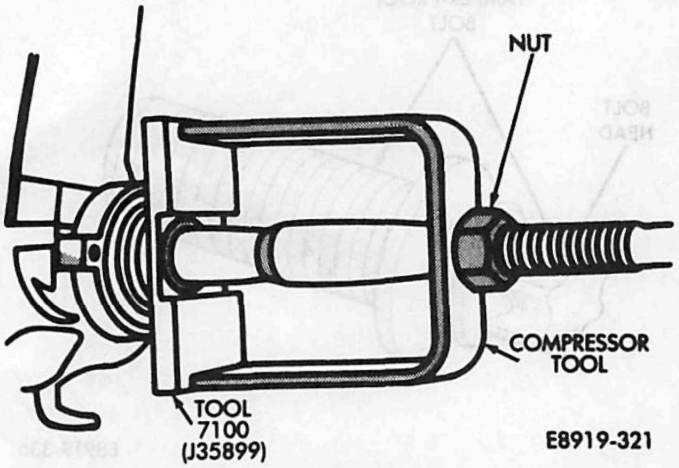


Fig. 62—Compressor Tool & Adapter Tool 7100

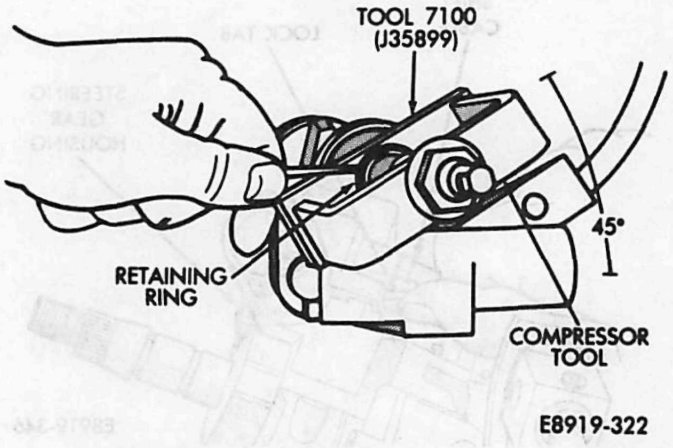


Fig. 63—Steering Shaft Retaining Ring Installation

(f) loosen the compressor tool nut, unthread the compressor tool shaft from the steering shaft hub and remove the compressor tool and the adapter tool.

(9) Position the ignition switch on the key-lock cylinder housing and install the two retaining screws.

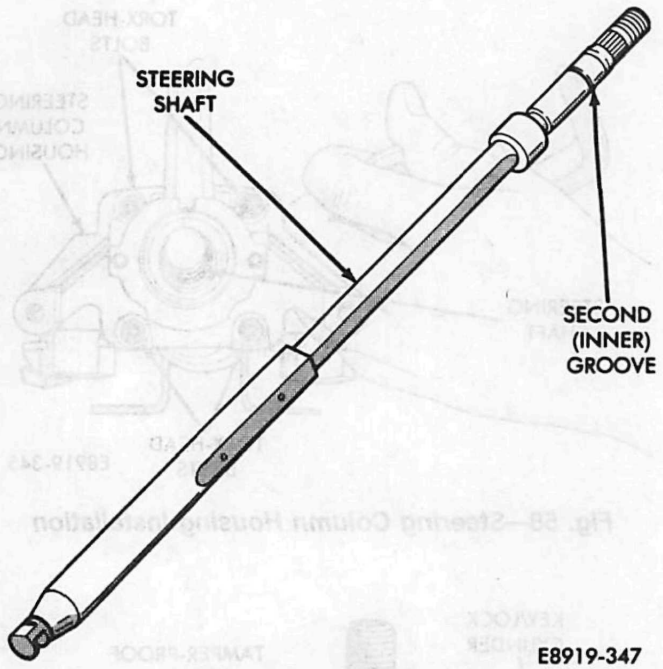


Fig. 64—Steering Shaft

(10) Position the shroud bracket on the housing and install the three shroud bracket-to-housing screws.

(11) Position the turn signal switch adapter on the steering column housing and install the two adapter-to-housing screws.

(12) Position the turn signal switch on the switch adapter and install the three retaining screws.

(13) Install the wave washer and the cancelling cam on the turn signal switch.

(14) Turn the ignition key to the unmarked position and install the key/lock cylinder in the cylinder housing.

(15) Position the shroud on the shroud bracket (Fig. 65).

(16) Install the shroud-to-bracket internal screws (Fig. 65).

(17) Attach the key/lock cylinder bezel to the shroud (Fig. 65).

(18) Position the control modules in the shroud and install the shroud-to-control module screws (Fig. 65).

(19) Slide the shroud upper cover over the gearshift lever and position it adjacent to the shroud and on the shroud bracket (Fig. 65).

(20) Install the two shroud bracket-to-upper cover screws (Fig. 65).

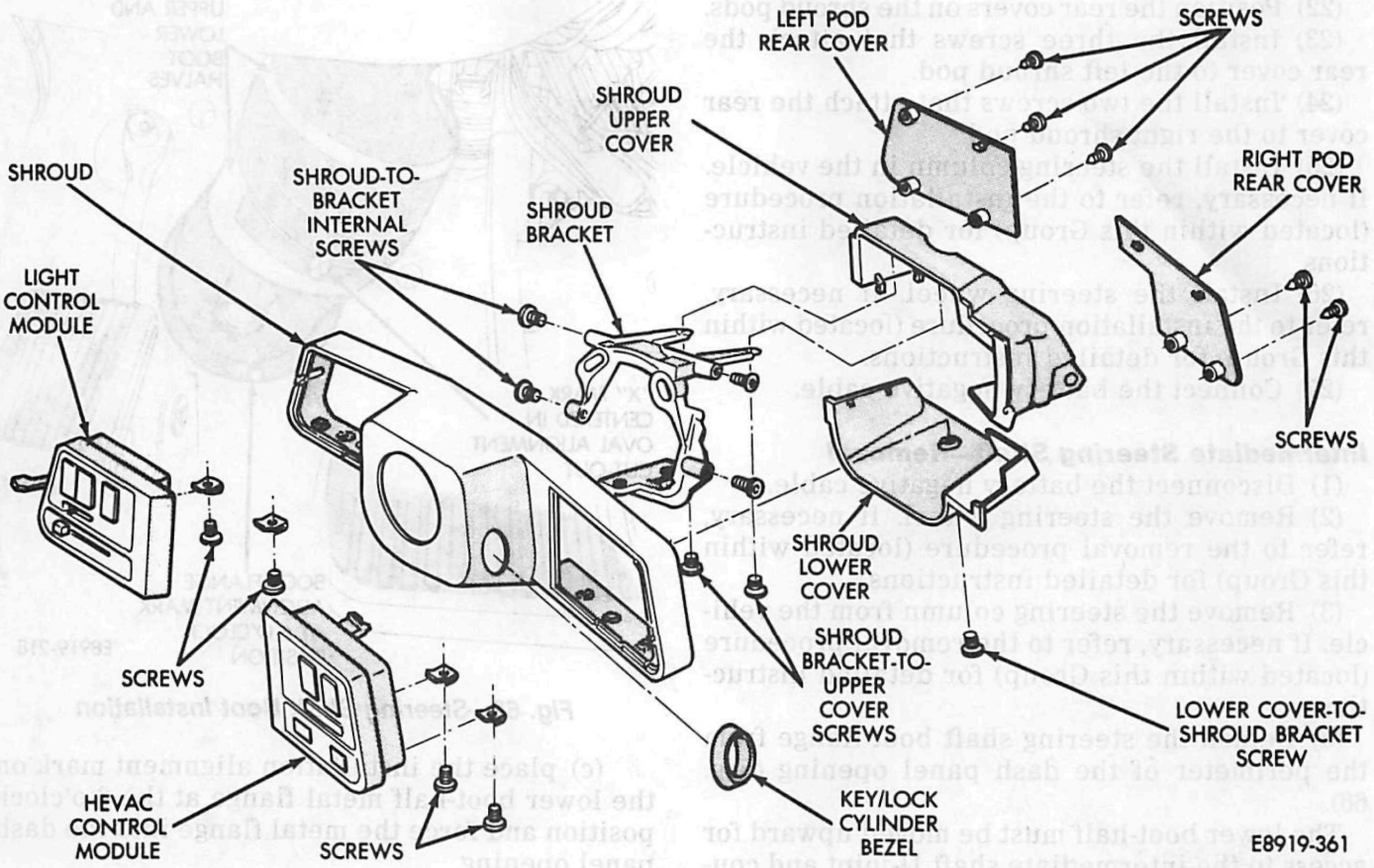


Fig. 65—Steering Column Shroud

(21) Carefully mate the lower cover with the upper cover by attaching the upper cover tab fasteners to the lower cover notches. Install the lower cover-to-shroud bracket screw (Fig. 65).

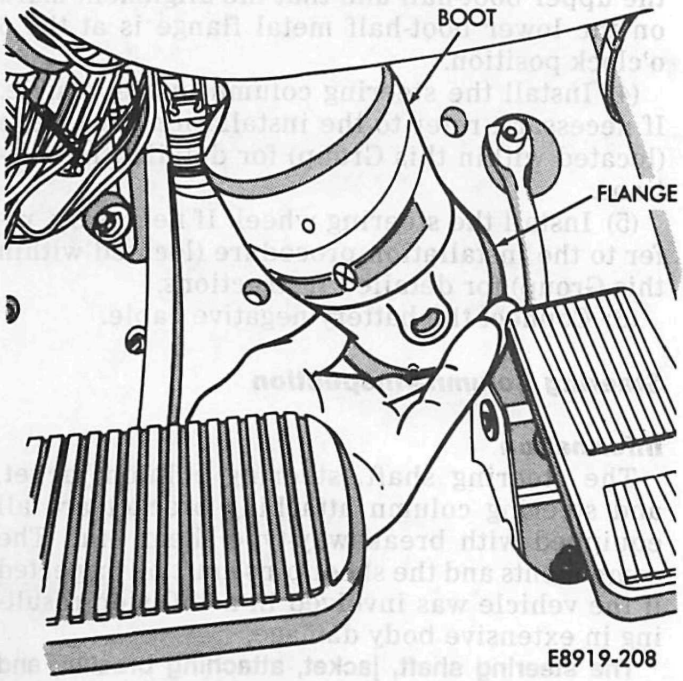


Fig. 66—Steering Shaft Boot

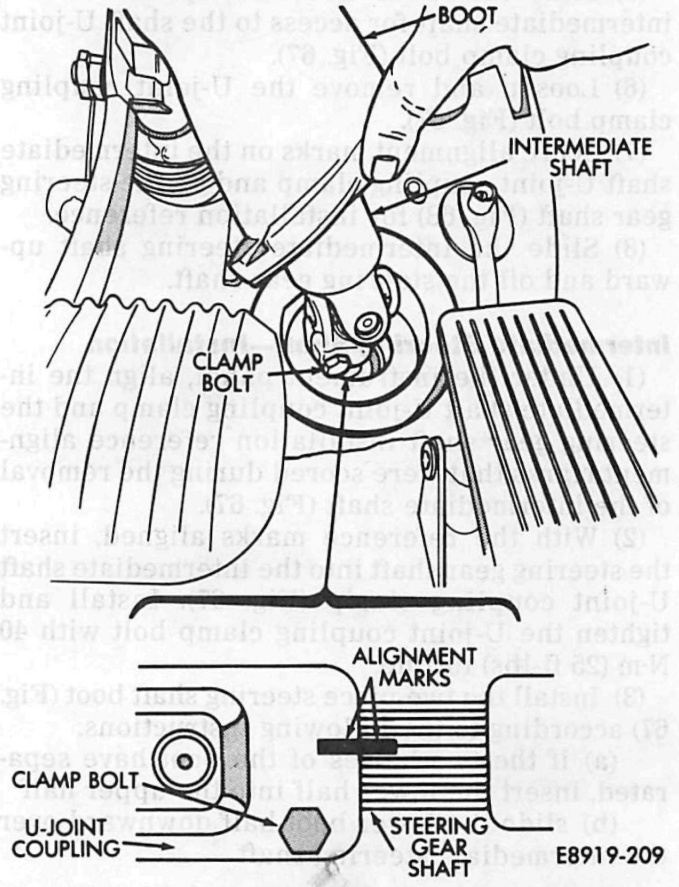


Fig. 67—U-Joint Coupling Clamp & Gear Shaft Marks

(22) Position the rear covers on the shroud pods.
(23) Install the three screws that attach the rear cover to the left shroud pod.
(24) Install the two screws that attach the rear cover to the right shroud pod.
(25) Install the steering column in the vehicle. If necessary, refer to the installation procedure (located within this Group) for detailed instructions.
(26) Install the steering wheel. If necessary, refer to the installation procedure (located within this Group) for detailed instructions.
(27) Connect the battery negative cable.

Intermediate Steering Shaft—Removal

(1) Disconnect the battery negative cable.
(2) Remove the steering wheel. If necessary, refer to the removal procedure (located within this Group) for detailed instructions.
(3) Remove the steering column from the vehicle. If necessary, refer to the removal procedure (located within this Group) for detailed instructions.
(4) Detach the steering shaft boot flange from the perimeter of the dash panel opening (Fig. 66).
The lower boot-half must be moved upward for access to the intermediate shaft U-joint and coupling clamp bolt (Fig. 66).
(5) Slide the lower boot-half upward on the intermediate shaft for access to the shaft U-joint coupling clamp bolt (Fig. 67).
(6) Loosen and remove the U-joint coupling clamp bolt (Fig. 67).
(7) Score alignment marks on the intermediate shaft U-joint coupling clamp and on the steering gear shaft (Fig. 68) for installation reference.
(8) Slide the intermediate steering shaft upward and off the steering gear shaft.

Intermediate Steering Shaft—Installation

(1) Under the instrument panel, align the intermediate shaft U-joint coupling clamp and the steering gear shaft installation reference alignment marks that were scored during the removal of the intermediate shaft (Fig. 67).
(2) With the reference marks aligned, insert the steering gear shaft into the intermediate shaft U-joint coupling clamp (Fig. 67). Install and tighten the U-joint coupling clamp bolt with 40 N·m (25 ft-lbs) torque.
(3) Install the two-piece steering shaft boot (Fig. 67) according to the following instructions:
(a) if the two halves of the boot have separated, insert the lower half into the upper half
(b) slide the lower boot-half downward over the intermediate steering shaft

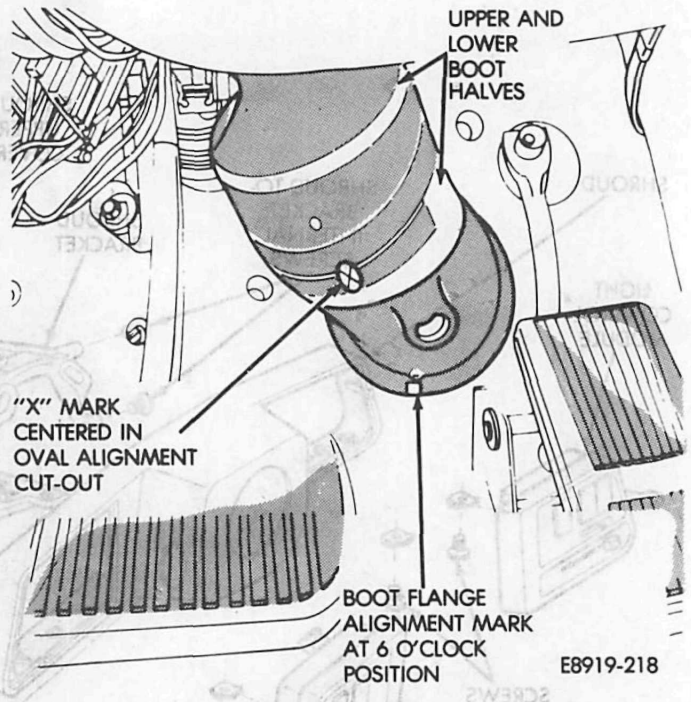


Fig. 68—Steering Shaft Boot Installation

(c) place the installation alignment mark on the lower boot-half metal flange at the 6 o'clock position and force the metal flange into the dash panel opening
(d) rotate the two halves of the boot until the X mark on the lower boot-half is centered in the oval shaped alignment cut-out in the upper boot-half as indicated in Figure 68
(e) verify that the lower boot-half X mark is centered in the oval shaped alignment cut-out in the upper boot-half and that the alignment mark on the lower boot-half metal flange is at the 6 o'clock position.
(4) Install the steering column in the vehicle. If necessary, refer to the installation procedure (located within this Group) for detailed instructions.
(5) Install the steering wheel. If necessary, refer to the installation procedure (located within this Group) for detailed instructions.
(6) Connect the battery negative cable.

Steering Column—Inspection

Information

The steering shaft, steering column jacket, and steering column attaching bracket are all equipped with breakaway-type shear pins. The components and the sheer pins must be inspected if the vehicle was involved in a collision resulting in extensive body damage.
The steering shaft, jacket, attaching bracket, and the shear pins should also be inspected if the steer-

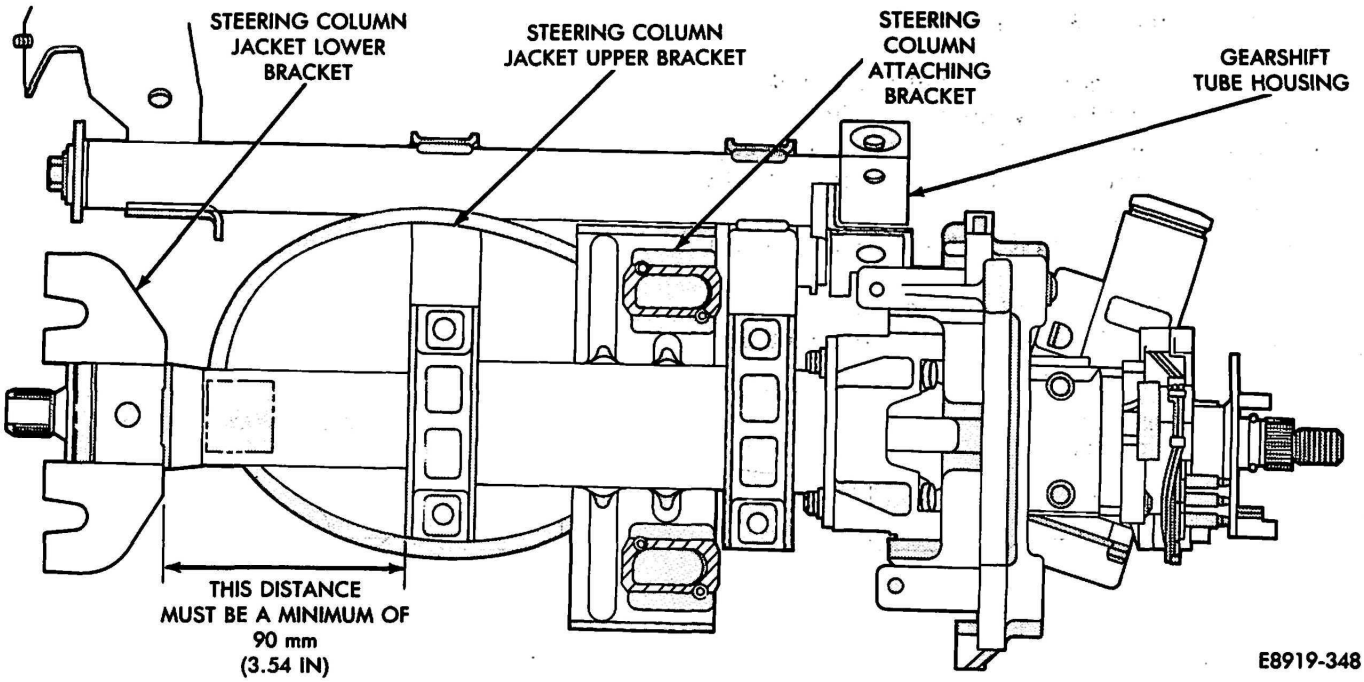


Fig. 69—Steering Column Jacket Bracket Measurement

ing column was dropped or impacted removed from the vehicle for service.

The methods of inspecting the steering column components are described in the following procedures.

CAUTION: The steering shaft, column jacket, and attaching bracket are designed to collapse from impact. This is a safety feature integral with the steering column. Do not attempt to repair or reuse a damaged or collapsed steering shaft, jacket or bracket. Damaged components must be replaced only.

Remove the steering wheel. If necessary, refer to the removal procedure (located within this Group) for detailed instructions.

Remove the steering column from the vehicle. If necessary, refer to the removal procedure (located within this Group) for detailed instructions.

Steering Column Jacket Brackets—Measurement

(1) Measure the distance between the upper and the lower steering column jacket brackets (Fig. 69). The distance must be a minimum of 90 mm (3.54 in.).

(2) Replace the steering column jacket if the distance measured the brackets is less than the specified minimum.

Steering Shaft Length—Measurement

(1) Remove the steering shaft from the steering column. Refer to the overhaul procedure (located within this Group) for detailed instructions.

(2) Examine steering shaft straightness. Use a metal straightedge for this examination. Replace the shaft if it is bent or warped more than 1.65 mm (0.065 in.).

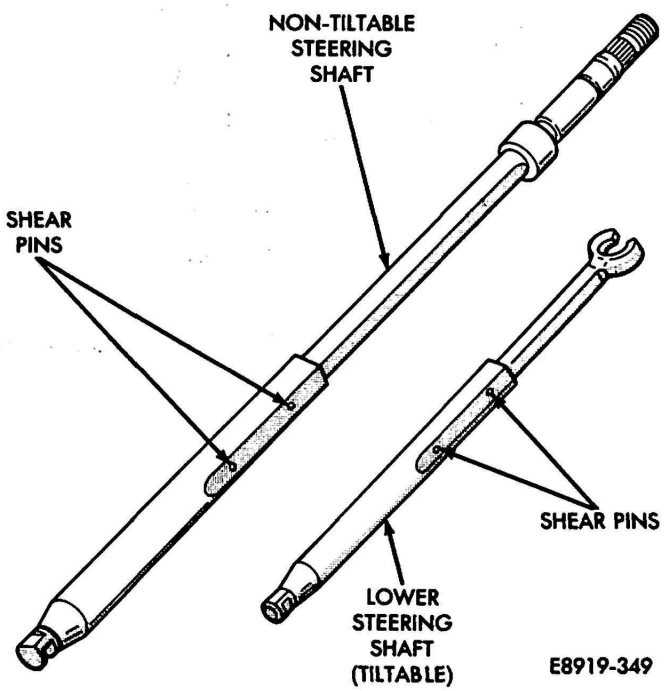


Fig. 70—Steering Shafts & Shear Pins

(3) Examine condition of the steering shaft shear pins (Fig. 70).

(4) Replace the steering shaft if the shear pins (Fig. 70) are broken or damaged in any way, or if the shaft is obviously collapsed.

Steering Column Attaching Bracket—Measurement

(1) The steering column attaching bracket is equipped with breakaway capsules (Fig. 71).

(2) Measure the clearance between the capsules and the bottom edge of the slots in the attaching bracket (Fig. 71).

(3) The clearance must not exceed 1.65 mm (0.065 in.).

(4) Replace the steering column jacket if the clearance between the capsules and bracket slots is greater than specified.

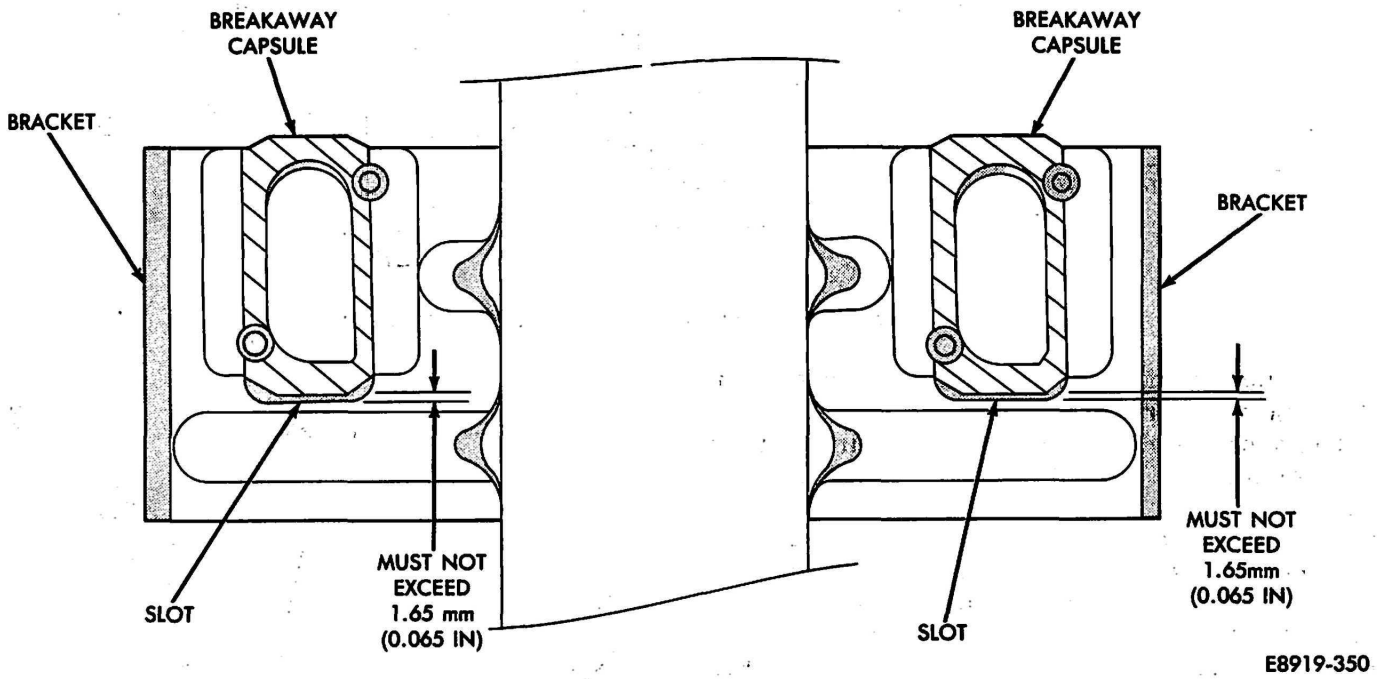


Fig. 71—Capsule-To-Slot Clearance Measurement

COMPONENT	SET-TO TORQUE	RECHECK TORQUE
STEERING GEAR BRACKET BOLT (M10 X 1.5 — 20 AND M10 X 1.5 — 90)	55 N•m (40 FT-LBS)	51-59 N•m (37-44 FT-LBS)
TIE ROD END-TO-STRUT NUT	48 N•m (35 FT-LBS)	38-52 N•m (28-38 FT-LBS)
POWER STEERING PRESSURE TUBING FITTING	30 N•m (22 FT-LBS)	27-33 N•m (20-24 FT-LBS)
POWER STEERING RETURN HOSE FITTING	30 N•m (22 FT-LBS)	27-33 N•m (20-24 FT-LBS)
POWER STEERING RESERVOIR-TO-CYLINDER HEAD COVER BRACKET BOLT	40 N•m (30 FT-LBS)	35-45 N•m (26-33 FT-LBS)
INTERMEDIATE SHAFT CLAMP-TO-STEERING GEAR BOLT	40 N•m (30 FT-LBS)	35-45 N•m (26-33 FT-LBS)
TIE ROD SHAFT-TO-STEERING GEAR SPACER BLOCK BOLT	75 N•m (55 FT-LBS)	68-81 N•m (50-60 FT-LBS)
STEERING COLUMN BRACKET NUTS	45 N•m (33 FT-LBS)	40-50 N•m (30-37 FT-LBS)
STEERING COLUMN BRACKET BOLTS	45 N•m (33 FT-LBS)	40-50 N•m (30-37 FT-LBS)
STEERING WHEEL HUB NUT	70 N•m (52 FT-LBS)	68-72 N•m (50-53 FT-LBS)
NUT, PROTECTIVE BOOT, STEERING GEAR PINION-TO-DASH PANEL	15 N•m (11 FT-LBS)	13-17 N•m (10-12 FT-LBS)
HUB-TO-STEERING WHEEL BOLT	10 N•m (7 FT-LBS)	9-11 N•m (7-8 FT-LBS)
TILT WHEEL LEVER	4 N•m (3 FT-LBS)	3-5 N•m (2-4 FT-LBS)
POWER STEERING PUMP REAR BRACKET-TO-INTAKE MANIFOLD BOLT (2.5L ENGINES)	40 N•m (30 FT-LBS)	33-47 N•m (24-35 FT-LBS)
POWER STEERING PUMP REAR BRACKET-TO-WATER PUMP BOLT (2.5L ENGINES)	40 N•m (30 FT-LBS)	33-47 N•m (24-35 FT-LBS)
TIE-ROD END ADJUSTMENT SLEEVE LOCKNUTS	49 N•m (36 FT-LBS)	46-52 N•m (34-38 FT-LBS)
POWER STEERING RESERVOIR-TO-CYLINDER HEAD COVER BRACKET BOLT	15 N•m (11 FT-LBS)	12-18 N•m (9-13 FT-LBS)
STABILIZER BAR-TO-CRADLE CLAMP BOLT	28 N•m (21 FT-LBS)	26-31 N•m (19-23 FT-LBS)
DRIVESHAFT NUT	245 N•m (181 FT-LBS)	225-265 N•m (166-195 FT-LBS)

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COMPONENT	SET-TO TORQUE	RECHECK TORQUE
DISC BRAKE CALIPER-TO SUSPENSION KNUCKLE BOLT	95 N•m (70 FT-LBS)	85-105 N•m (63-77 FT-LBS)
FRONT WHEEL BEARING-TO-SUSPENSION KNUCKLE BOLT	15 N•m (11 FT-LBS)	13-17 N•m (9-13 FT-LBS)
BALL JOINT AND STABILIZER BAR-TO-SUSPENSION ARM NUT	82 N•m (60 FT-LBS)	74-90 N•m (55-66 FT-LBS)
SUSPENSION ARM-TO-ENGINE CRADLE NUT	140 N•m (103 FT-LBS)	125-155 N•m (92-114 FT-LBS)
BALL JOINT-TO-SUSPENSION KNUCKLE PINCH BOLT NUT	105 N•m (77 FT-LBS)	95-115 N•m (70-85 FT-LBS)
POWER STEERING PUMP ADJUSTMENT BRACKET-TO-WATER PUMP BOLT (2.5L ENGINES)	40 N•m (30 FT-LBS)	33-47 N•m (24-35 FT-LBS)
POWER STEERING PUMP ADJUSTMENT BRACKET-TO-REAR BRACKET BOLT (2.5L ENGINES)	27 N•m (20 FT-LBS)	20-34 N•m (15-25 FT-LBS)
POWER STEERING PUMP FRONT BRACKET-TO-PUMP BOLT (2.5L ENGINES)	27 N•m (20 FT-LBS)	20-34 N•m (15-25 FT-LBS)
POWER STEERING PUMP FRONT BRACKET (PIVOT)-TO-REAR BRACKET BOLT AND WASHER (2.5L ENGINES)	27 N•m (20 FT-LBS)	20-34 N•m (15-25 FT-LBS)
POWER STEERING PUMP REAR BRACKET (ADJUSTMENT)-TO-PUMP BOLT AND WASHER (2.5L ENGINES)	27 N•m (20 FT-LBS)	20-34 N•m (15-25 FT-LBS)
POWER STEERING ADJUSTMENT BRACKET-TO-STUD NUT (2.5L ENGINES)	27 N•m (20 FT-LBS)	20-34 N•m (15-25 FT-LBS)
POWER STEERING PUMP REAR BRACKET-TO-TIMING COVER STUD BOLT (V6 ENGINES)	40 N•m (30 FT-LBS)	33-47 N•m (24-35 FT-LBS)
POWER STEERING PUMP REAR BRACKET-TO-SUMP BOLT (V6 ENGINES)	27 N•m (20 FT-LBS)	20-34 N•m (15-25 FT-LBS)
POWER STEERING PUMP AND FRONT BRACKET-TO-REAR BRACKET (V6 ENGINES):		
STUD	20 N•m (15 FT-LBS)	13-27 N•m (10-20 FT-LBS)
NUT	40 N•m (30 FT-LBS)	33-47 N•m (24-35 FT-LBS)
BOLT	40 N•m (30 FT-LBS)	33-47 N•m (24-35 FT-LBS)
POWER STEERING PUMP FRONT BRACKET-TO-STUD NUT (V6 ENGINES)	40 N•m (30 FT-LBS)	33-47 N•m (24-35 FT-LBS)
POWER STEERING PUMP FRONT BRACKET-TO-TIMING COVER BOLT (V6 ENGINES)	27 N•m (20 FT-LBS)	20-34 N•m (15-25 FT-LBS)

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TRANSAXLE

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ZF-4 AUTOMATIC TRANSAXLE

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GENERAL INFORMATION

The ZF-4 is a four-speed, automatic transaxle. Third gear ratio is 1:1. Fourth gear is an overdrive range providing an 0.74:1 gear ratio.

The transmission and differential sections are not integral in the ZF-4 transaxle. They are separate and require different lubricants.

Transmission shifting is controlled by a governor valve, a line pressure valve, a throttle pressure regulator valve, and a modulator valve. Valve operation is dependent on shift lever position, vehicle speed and throttle position.

A lockup torque converter is used with the ZF transaxle. The ignition TDC sensor is activated by a stamped steel trigger wheel attached to the torque converter drive plate.

The ZF transaxle is equipped with a planetary gear system consisting of an annulus gear, sun gear, and planetary carrier. A total of six planetary pinion gears are used.

Two styles of freewheel clutch are used. A roller clutch is used for first gear operation and a sprag clutch is used for second gear operation.

TRANSAXLE SERVICE PROCEDURES

Service procedures in this Group include service diagnosis, general specifications, transaxle removal and installation, and in-vehicle service procedures.

ZF-4 TRANSAXLE IDENTIFICATION

The transaxle identification plate is on the left side of the case above the oil pan (Fig. 1).

The information on the plate consists of the build sequence number, manufacturers part number, and the transaxle type (Fig. 2).

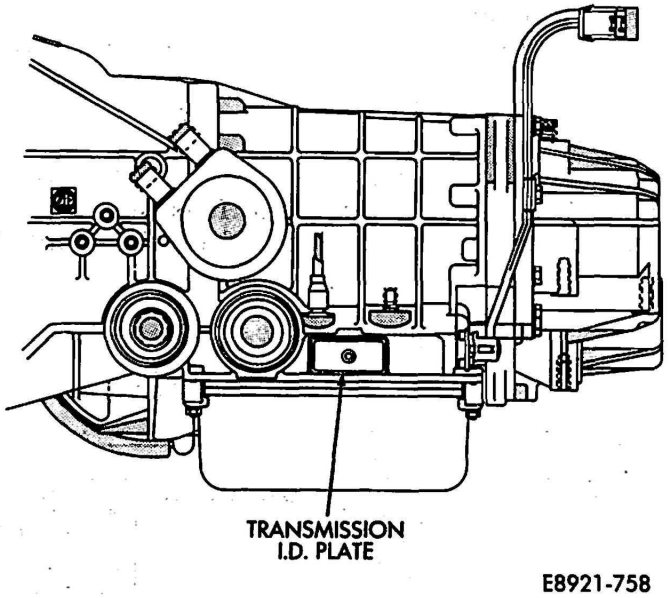


Fig. 1—Transaxle Identification Plate Location

ZF-4 TRANSAXLE FLUID TYPES AND CAPACITY

The transmission and differential are not integral in the ZF-4 transaxle. They are separate and require different lubricants.

Transmission Fluid Type

The transmission requires Mopar Mercon™ automatic transmission fluid. This is the only fluid to be used in the ZF-4 transmission. Do not substitute any other type of fluid.

Transmission Fluid Capacity

Two fluid capacities are provided. The refill capacity is the approximate amount required to fill the transmission after major repairs. The fluid change capacity is the approximate amount required to fill the transmission after a fluid change only.

- Approximate refill quantity after major repair is: 7.0 liters (7.4 U.S. qts).
- Approximate fluid/filter change quantity is: 2.6 liters (2.8 U.S. qts).

The easiest refill method is as follows: Add 5.0 liters of fluid after major repair. Add 2.0 liters of fluid after minor service. Then start the engine. Shift through all gear ranges and top off the fluid level as described in the fluid level check procedure.

Differential Lubricant Type

The differential requires a synthetic-type SAE grade 75W-140 gear lubricant. It is the only lubricant recommended. The differential is filled with this grade of synthetic lubricant at the factory. Capacity is 0.7 liters (0.66 U.S. qts).

The synthetic lubricant is designed to last for the life of the differential under normal conditions. Periodic lubricant changes are not required.

Transmission Drain/Fill Location

The transmission is drained by disconnecting the fill tube at the oil pan (Fig. 3). Loosen the fill tube nut and drain the fluid.

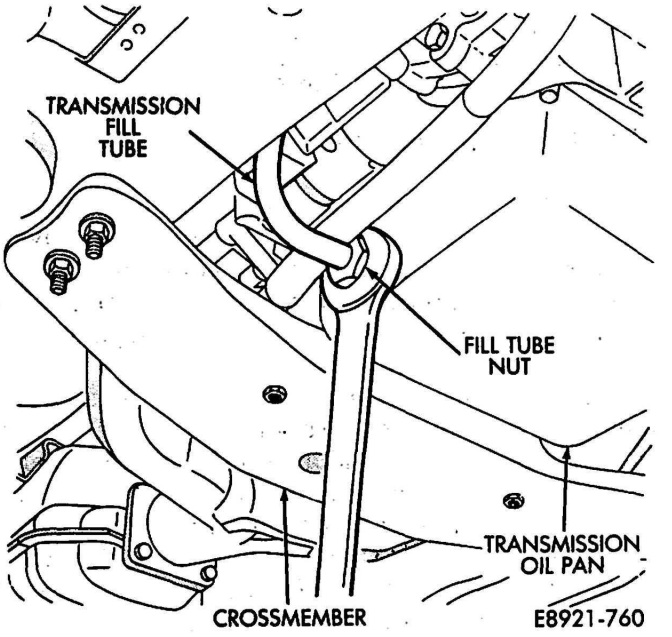


Fig. 3—Draining Transmission Fluid

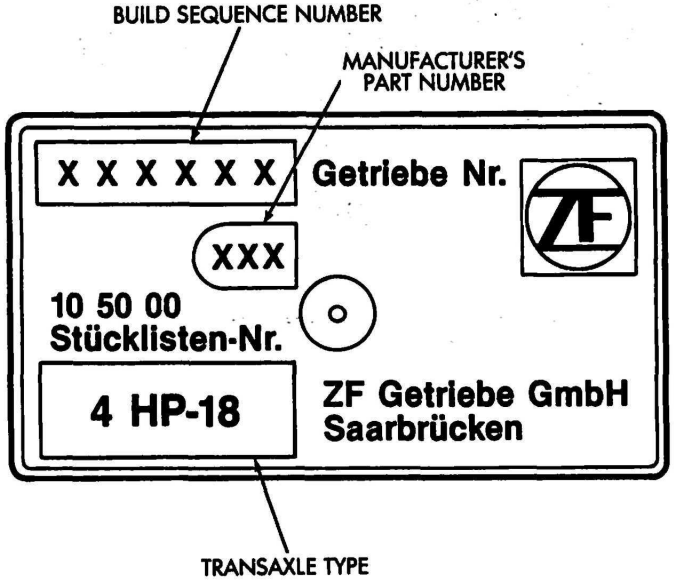


Fig. 2—Identification Plate Information

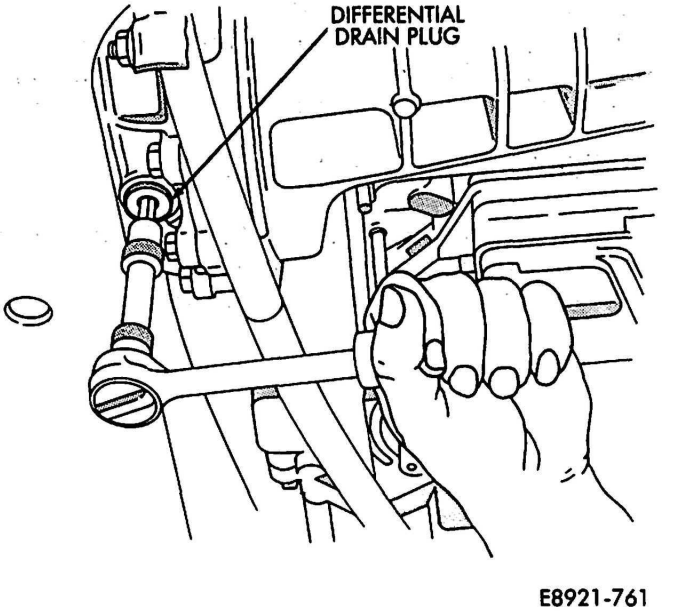


Fig. 4—Differential Drain Plug Location

The transmission fill tube is at the right, front side of the transmission.

Differential Drain/Fill Location

The differential drain plug is at the bottom of the differential cover (Fig. 4). The fill plug is at the left, center section of the cover (Fig. 5).

SERVICE DIAGNOSIS

General Information

Automatic transaxle problems can be a result of poor engine performance, incorrect fluid level, incorrect cable adjustment, hydraulic system malfunctions, or mechanical component malfunctions.

Begin diagnosis by checking the easily accessible items such as fluid level and condition and cable adjustments. A road test will determine if further diagnosis is necessary.

Preliminary Diagnosis

Two basic procedures are required. One procedure for vehicles that are driveable and an alternate procedure for disabled vehicles (will not back up or move forward).

Vehicle Is Driveable

(1) Check fluid level and condition.

(2) Adjust throttle and shift cables if complaint was based on delayed, erratic, or harsh shifts.

(3) Road test and note transmission operating characteristics.

(4) Refer to diagnosis charts for further information.

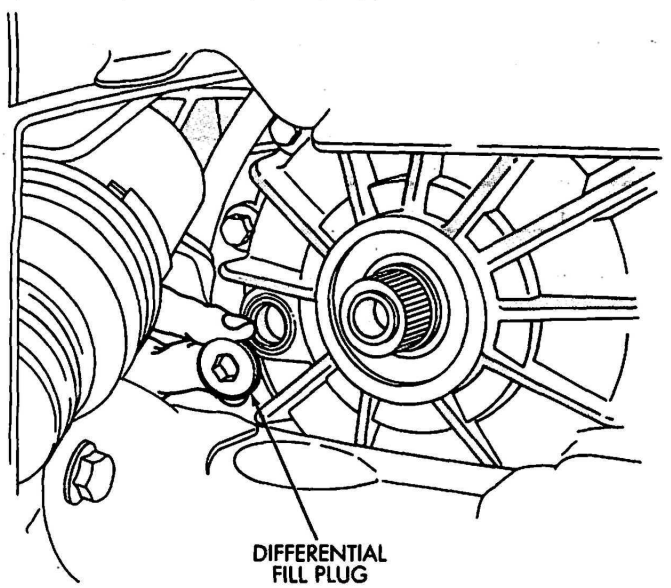


Fig. 5—Differential Fill Plug Location

Vehicle Is Disabled

(1) Check fluid level and condition.

(2) Check for broken, disconnected throttle or shift cable.

(3) Check for cracked, leaking cooler hoses.

(4) Raise vehicle, start engine, shift transaxle into gear and note following:

(a) If axle shaft turns but wheels do not, problem is with shafts, U-joints, or wheel hub.

(b) If axle shafts do not turn and transaxle is noisy, stop engine. Remove oil pan, and check for debris. If pan is clear, remove transaxle and check for damaged drive plate, converter, oil pump, input shaft, or differential.

(c) If axle shafts do not turn and transmission is not noisy, remove and repair or replace transaxle as needed.

Fluid Level And Condition

(1) To avoid false readings, which could produce under or over fill condition, do not check level until fluid is at normal operating temperature.

(2) Shift transaxle into Neutral.

(3) Apply parking brakes.

(4) Operate engine at curb idle speed.

WARNING: WHEN PERFORMING UNDERHOOD OPERATIONS WITH THE ENGINE RUNNING, KEEP YOUR HANDS WELL AWAY FROM HOT OR ROTATING ENGINE COMPONENTS. DO NOT WEAR LOOSE ARTICLES OF CLOTHING WHICH COULD BECOME ENTANGLED IN ENGINE COMPONENTS OR ACCESSORIES.

(5) Clean dipstick filler cap and tube before removing dipstick.

(6) Remove dipstick and inspect fluid level. Correct level is between ADD and FULL HOT marks on dipstick.

(7) Check fluid condition. Fluid should be dark red to light red in color and free of dirt or debris.

(8) If fluid is discolored or smells burned but transaxle operation was OK, flush cooler and lines and change fluid and filter. Then road test again to confirm proper operation.

(9) If fluid is black or dark brown, burned or turned to sludge, and contains large quantities of metal or friction material particles, transaxle may have to be replaced; Especially if problems were evident during road test and preliminary diagnosis.

Effects of Incorrect Fluid Level

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal.

If the transmission is overfilled, the gears churn the fluid into foam, aerating the fluid and caus-

ing the same conditions that occur with a low level.

In either case, air bubbles cause fluid overheating, oxidation and varnish buildup which interferes with valve, clutch and brake operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

Throttle Cable

The throttle cable positions a valve which controls shift speed, quality and part throttle downshift sensitivity. If cable setting is too short, early shifts and slippage between shifts may occur. If the setting is too long, shifts may be delayed and part throttle downshifts may be very sensitive. Refer to the In-Vehicle Service section for adjustment procedure.

Shift Cable

The shift cable positions the valve body manual valve. Incorrect adjustment will cause creeping in Neutral, premature clutch wear, delayed engagement in any gear, or a no-start in Park or Neutral position.

Road Test

Before road testing, be sure fluid level and cable adjustment are correct. Observe engine performance during the road test. A poorly tuned engine will prevent accurate analysis of transaxle operation.

Operate the transaxle in all gear ranges. Check for slippage and shift variations. Note when shifts are harsh, spongy, delayed, early, or if downshifts are sensitive.

Watch closely for engine flare which usually indicates clutch, band or overrunning clutch problems. If the condition is advanced, an overhaul may be necessary to restore normal operation.

A slipping clutch, band or brake can be determined by comparing which elements are applied in the various gear ranges. The following application chart (Fig. 6) provides a basis for analyzing road test results.

Component	Gear Drive				
	First	Second	Third	Fourth	Reverse
1-3 Clutch	•	•	•		
Reverse Clutch					•
Forward Brake		•			
2-4 Band		•		•	
First-Reverse Brake	•				•
3-4 Clutch			•	•	
Roller Clutch	•				
Sprag Clutch		•			

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Fig. 6—Clutch-Band-Brake Application Chart

Condition	Possible Cause	Correction
WILL NOT ENGAGE OR HOLD IN PARK	• Shift cable incorrectly adjusted. • Excess clearance on detent plate. • Detent segment out of position. • Park pawl damaged. • Locking cam worn.	• Adjust cable. • Adjust or replace plate. • Correct position or replace segment and rod. • Replace pawl and pin. • Replace cam.
ENGINE WILL NOT CRANK	• Shift cable incorrectly adjusted. • Neutral switch inoperative. • Excess clearance on selector shaft.	• Adjust cable. • Replace switch. • Adjust or replace shaft.
NO REVERSE	• Low fluid level. • Shift cable incorrectly adjusted. • Oil screen contaminated, plugged. • Reverse clutch damaged. • First-reverse brake damaged. Also, engine will not decelerate in position one, first gear. • Governor sticking. • Lock-up valve 1 and reverse gear sticking.	• Top off fluid. Check for leaks and repair if necessary. • Adjust cable. • Replace oil screen. • Replace transmission. • Replace transmission. • Replace governor. • Replace valve body.
SLIPS/VIBRATES WHEN ACCELERATING FROM STOP	• 1-2-3 clutch damaged. • First-reverse brake damaged. • Turbine shaft O-ring or pump starter malfunction. • Oil leaking into reverse clutch or piston ring has scored center plate seat.	• Replace transmission.

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Condition	Possible Cause	Correction
HARSH P-TO-R OR N-TO-R ENGAGEMENT; MAY BE ACCOMPANIED BY IMPROPER 2-1 DOWNSHIFT	• Accumulator inoperative.	• Replace valve body.
BACK-UP LIGHTS NOT FUNCTIONING (ELECTRICAL FEED/GROUNDS ARE OK)	• Neutral start switch malfunction. • Shift cable misadjusted. • Selector cam damaged.	• Replace switch. • Adjust cable. • Replace cam assembly.
VEHICLE CREEPS IN PARK OR NEUTRAL	• Shift cable incorrectly adjusted.	• Adjust cable.
NO POWER, POOR ACCELERATION IN D RANGE	• Shift cable incorrectly adjusted. • Converter clutch worn. • Converter valve open. • Oil screen plugged. • 1-2-3 clutch defective. • Roller clutch slips. • Throttle or shift valve sticking.	• Correct adjustment. • Replace converter. • Replace transmission. • Replace oil screen. • Replace transmission. • Replace transmission. • Replace valve body.

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Condition	Possible Cause	Correction
HARSH ENGAGEMENT DURING N-TO-D SHIFT	• Accumulator sticking or spring broken.	• Replace valve body.
	• 1-2-3 clutch damaged.	• Replace transmission.
NO SHIFT IN COLD OR WARM CONDITION:		
• No 1-2 or 2-1 shift	• Governor contaminated (sticking).	• Replace governor.
	• 1-2 shift valve sticks.	• Replace valve body.
• No 1-2 shift	• Forward brake or 2-4 band malfunction.	• Replace transmission.
• No 2-3 or 3-2 shift	• Governor contaminated (sticking).	• Replace governor.
	• 2-3 shift valve sticks.	• Replace valve body.
• No 2-3 shift	• 3-4 clutch damaged.	• Replace transmission.
	• Oil supply for 3-4 clutch leaking.	• Replace transmission.
• No 3-4 or 4-3 shift	• Governor contaminated (sticking).	• Replace governor.
	• 3-4 shift valve sticks.	• Replace valve body.
• No 3-4 shift	• Forward brake inoperative (1-2 upshift not OK).	• Replace transmission.
	• 2-4 band loose.	• Replace transmission.
	• 2-3-4 upshift valve sticks.	• Replace valve body.
	• Position-3 valve sticks.	• Replace valve body.

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Condition	Possible Cause	Correction
• Vehicle takes off in 2nd gear (will not downshift back to 1st gear)	• Governor piston sticks.	• Replace governor.
	• 1-2 shift valve sticks.	• Replace valve body.
	• 2-4 band binds, drags or will not release.	• Replace band.
• Vehicle takes off in 3rd gear (will not downshift back to 1st or 2nd gear)	• Center rectangular ring of governor flange damaged.	• Replace transmission.
	• Governor piston sticking.	• Replace governor.
	• 1-2 and 2-3 shift valves sticking.	• Replace valve body.
	• Closing cap in center plate leaking (reverse clutch always filled with oil).	• Replace transmission.
• Transmission shifts 1-3 (no 2nd gear)	• 2-3 shift valve sticks.	• Replace valve body.
	• 2-3-4 shift valve sticks.	• Replace valve body.
	• 1-2-3 shift valve sticks.	• Replace valve body.
• Transmission shifts 1-4 (no 1-2 or 2-3 shift)	• Shift valve problem.	• Replace valve body.
WILL NOT DOWNSHIFT TO 1ST AT IDLE OR NO KICKDOWN SHIFT:		
• Will not return to 1st gear at idle speed when stopped	• Governor sticking.	• Replace governor.
	• Leakage in governor assembly.	• Replace transmission.
	• Shift valve binding.	• Replace valve body.
• No full throttle kickdown	• Throttle valve cable incorrectly adjusted.	• Adjust cable.
• No kickdown shifts 1-2/ 2-1, 2-3/3-2, or 3-4/4-3	• Throttle valve cable incorrectly adjusted.	• Adjust cable.
	• Throttle valve cable incorrectly adjusted.	• Adjust cable.
	• Throttle valve cable incorrectly adjusted.	• Adjust cable.
	• Governor sticking.	• Replace governor.

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Condition	Possible Cause	Correction
• Harsh engagement at idle speeds	• Accumulator malfunction. • Modulator pressure too high. • Clutch pack damage.	• Replace valve body. • Replace valve body. • Replace transmission.
• Full throttle and kickdown shifts too long	• Accumulator malfunction. • Modulator pressure too low. • Clutch pack damage.	• Replace valve body. • Replace valve body. • Replace transmission.
• Full throttle and kickdown shifts are harsh	• Modulator pressure not OK. • Accumulator malfunction.	• Replace valve body. • Replace valve body.
• Engine overspeed (flare) when 3-4 shift occurs	• Orifice control valve sticking. • Throttle cable misadjusted. • 3-4 traction valve binding. • 2-4 band slips. • 3-4 clutch damaged.	• Replace valve body. • Adjust cable. • Replace valve body. • Replace transmission. • Replace clutch.
• Engine overspeed (flare) during 4-3 downshift **NOTE:** Check fluid level and condition and oil screen (plugged) before assuming clutch damage.	• Time control valve and 4-3 downshift valves not coordinated. • 1-2-3 clutch damaged. • Damper function of 1-2-3 clutch and 4-3 traction valve not functioning properly.	• Replace valve body. • Replace transmission. • Replace valve body.
MANUAL 2ND GEAR (D POSITION) DOWNSHIFT INCORRECT OR DOWNSHIFT EARLY OR LATE	• Lockup valve 2 binding. • Governor piston binding.	• Replace valve body. • Replace governor.
NO OVERRUN BRAKING IN D1	• 2-4 band inoperative. • 2-4 band damaged.	• Check/replace band piston and cover O-rings if required. • Replace transmission.

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Condition	Possible Cause	Correction
MANUAL 2-1 DOWNSHIFT INCORRECT	• Lockup valve 1 and reverse gear binding. • Governor piston binding. **NOTE:** Lockup valve 1 prevents downshift to 1st gear when speed is 25 mph or more.	• Replace valve body. • Replace governor.
NO OVERRUN BRAKING IN FIRST GEAR (1 POSITION) OR NO REVERSE	• First-reverse brake damaged.	• Replace transmission.
THROTTLE VALVE CABLE STICKS	• Cable not attached to cam. • Internal friction in cable. • Throttle pressure piston sticks.	• Connect cable to cam. • Replace cable. • Replace valve body.
AFTER LONG DRIVE, NOISE DEVELOPS AND VEHICLE WILL NOT MOVE IN DRIVE OR REVERSE	• Valve body oil screen plugged.	• Replace oil screen.
TRANSMISSION NOISY, WILL NOT MOVE IN DRIVE OR REVERSE	• Converter driveplate damaged. • Oil pump gears worn or damaged.	• Replace driveplate. • Replace transmission.

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Condition	Possible Cause	Correction
OIL LEAKING FROM CONVERTER HOUSING	• Torque converter leaking at welded seam. • Pump seal leaking.	• Replace converter. • Replace pump seal.
• Leakage between transmission and oil pan	• Oil pan bolts loose or pan is warped. • Oil pan gasket damaged.	• Tighten bolts or replace pan. • Replace gasket.
• Leakage between transmission housing and differential cover	• Cover bolts loose.	• Tighten bolts.
• Leakage at transmission cooler	• Cooler attaching bolt loose. • Gasket damaged. • Cooler cracked or split.	• Tighten bolt. • Replace gasket. • Replace cooler.
• Leakage at 2-4 band piston cover	• Cover O-rings worn or damaged.	• Replace O-rings.

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Condition	Possible Cause	Correction
• Leakage from 2-4 band retaining shaft	• Retaining shaft O-ring damaged.	• Remove valve body and replace shaft O-ring.
• Leakage at output shaft	• Bolts loose. • Seal rings damaged.	• Tighten bolts. • Replace seal rings.
• Oil leakage from throttle cable connection in case	• Cable connector O-ring damaged.	• Replace O-ring; if necessary, replace cable.
• Leakage at differential	• Output shaft seals or cover seal leaking.	• Replace seals.
• Leakage at speedometer sensor	• Sensor or O-ring damaged.	• Replace O-ring or sensor.

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ZF IN-VEHICLE SERVICE

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TRANSMISSION FLUID LEVEL CHECK

(1) Check fluid level when fluid is at normal operating temperature. If fluid is cold, run engine until cooling fan cycles three times before checking level.

CAUTION: Allow the fluid to cool for a minimum of 30 minutes if the vehicle was recently driven under the following conditions: (a) driven at highway speeds for an extended period. (b) used for trailer towing. (c) operated for lengthy period with A/C system at Max setting. (d) driven in stop and go traffic when ambient temperatures are high.

(2) Position vehicle on a level surface.

(3) Operate engine at curb idle speed.

(4) Shift transmission through all gear ranges.

(5) Return to Park position and check fluid level.

(6) Correct level is to Full Hot mark on dipstick (Fig. 1).

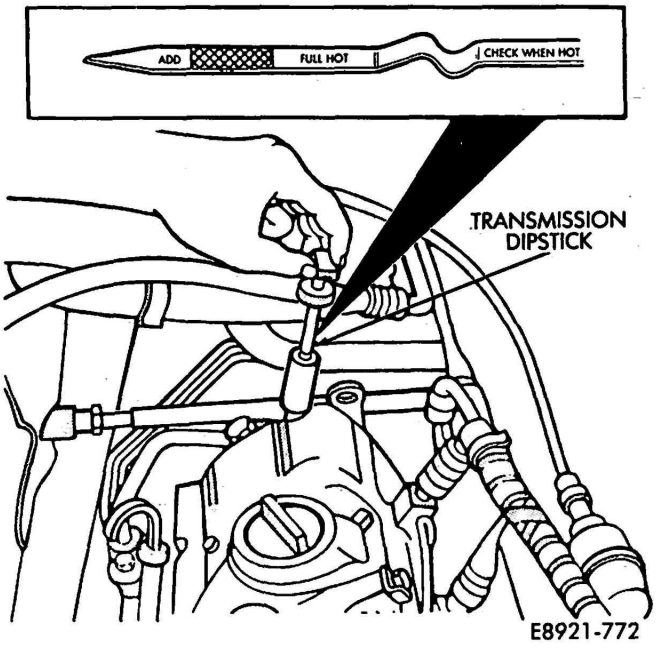


Fig. 1—ZF Transmission Fluid Level

(7) Add or drain fluid if necessary. The only fluid recommended for ZF transmission is Mopar-Mercon™ automatic transmission fluid.

(8) If additional fluid is required, add fluid in small amounts. It only takes 1/2 pint (0.25 liters) of fluid to raise the level from the ADD mark to the FULL HOT mark.

TRANSMISSION FLUID CHANGE

(1) Raise vehicle and remove underbody splash shield.

(2) Loosen nut attaching fill tube to oil pan and drain fluid (Fig. 2).

(3) Tighten fill tube nut (Fig. 2) to 100 N·m (74 ft-lbs) torque after draining fluid.

(4) Install underbody splash shield and lower vehicle.

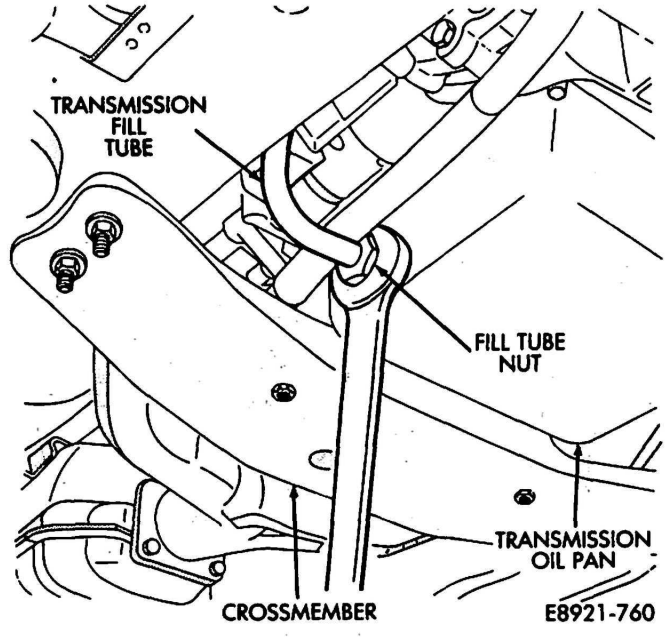


Fig. 2—Draining Transmission Fluid

(5) Remove the transmission dipstick and add Mercon™ transmission fluid to transmission through fill tube.

(6) Check and adjust fluid level. Add fluid in small amounts. It only requires 1/2 pint (.25 liters) of fluid to raise level from ADD to FULL HOT mark.

DIFFERENTIAL LUBRICANT CHANGE

(1) Raise vehicle and remove underbody splash shield.

(2) Remove differential drain plug and drain lubricant (Fig. 3).

(3) Install new washer on drain plug. Install and tighten plug to 25 N·m (18 ft-lbs) torque.

(4) Remove differential fill plug (Fig. 4) and install new washer on plug.

(5) Fill differential with 75W-140 synthetic-type hypoid gear lubricant.

(6) Continue adding lubricant until it starts to flow out of fill plug hole. Then install and tighten fill plug to 50 N·m (37 ft-lbs) torque.

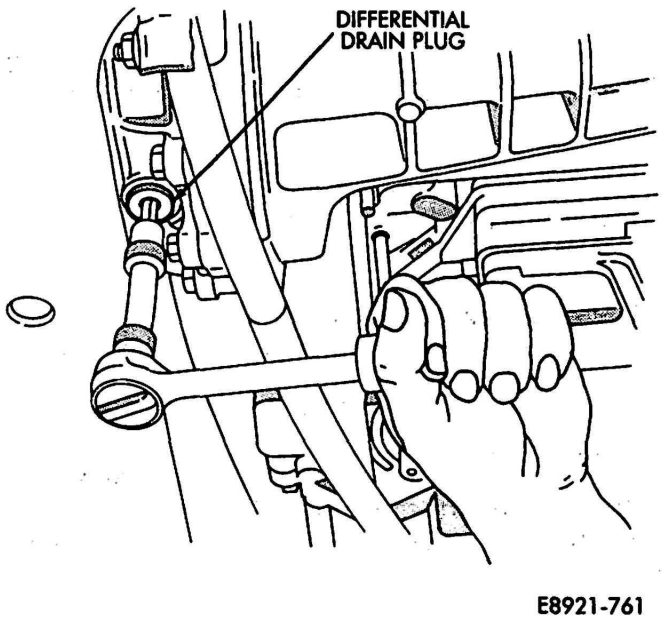


Fig. 3—Differential Drain Plug

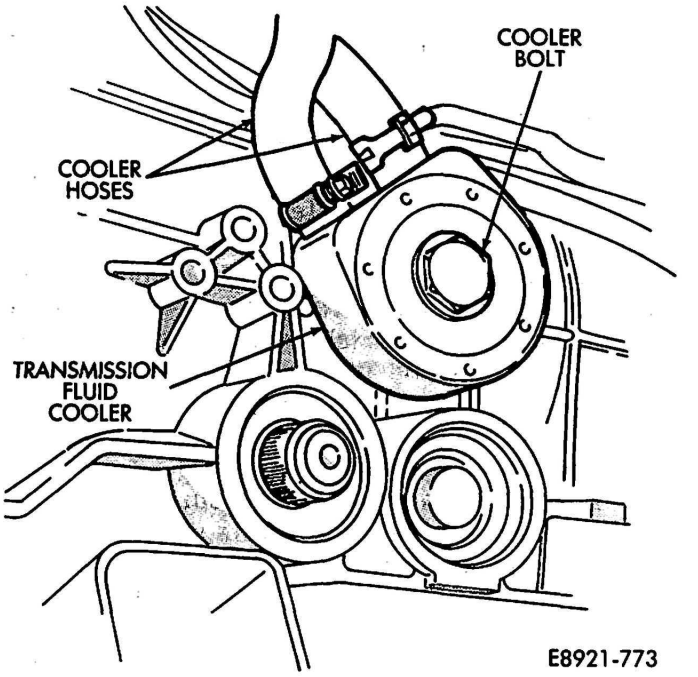


Fig. 5—Transmission Fluid Cooler and Hoses

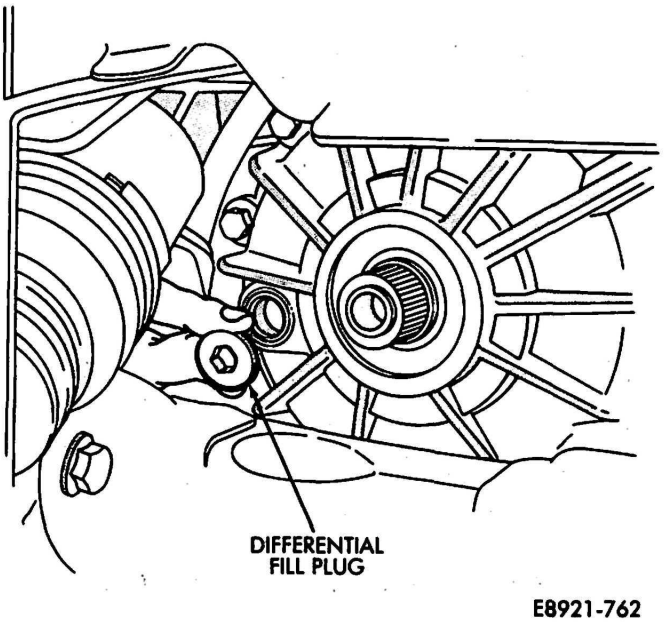


Fig. 4—Differential Fill Plug

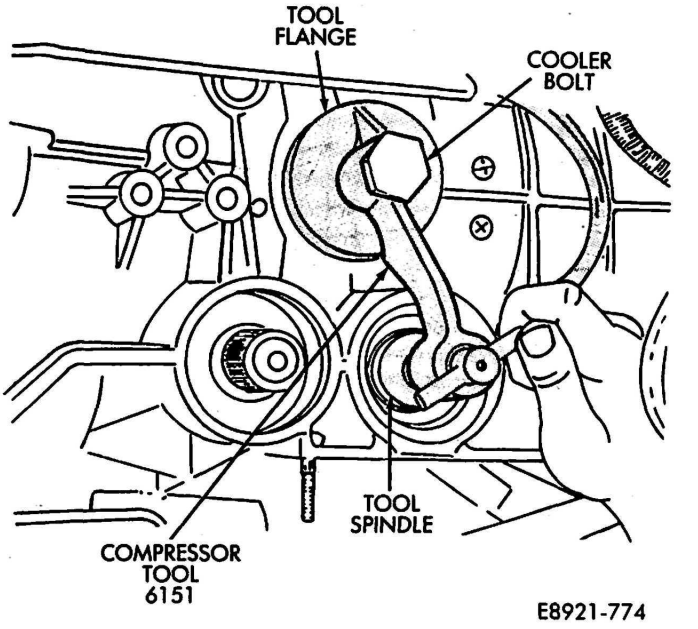


Fig. 6—Compressing 2-4 Band Cover And Piston

FLUID COOLER REPLACEMENT

(1) Raise vehicle and remove underbody splash shield.
(2) Disconnect fluid cooler hoses at cooler (Fig. 5).
(3) Note cooler position for installation reference (Fig. 5).
(4) Remove cooler bolt and remove cooler (Fig. 5).
(5) Clean and inspect cooler. Replace it if damaged.
(6) Position cooler on transmission case. Cooler hose outlets should be at 45 degree angle (Fig. 5).
(7) Install and tighten cooler attaching bolt to 50 N·m (37 ft-lbs) torque.
(8) Install and tighten cooler hoses.

2-4 BAND COVER AND PISTON SERVICE

2-4 Band Cover and Piston Removal

(1) Remove transmission fluid cooler.
(2) Compress piston and cover and remove cover snap ring as follows:
(3) Position the spindle of compressor tool 6151 on piston cover (Fig. 6).
(4) Position flange part of tool 6151 on transmission cooler boss and secure tool with fluid cooler bolt (Fig. 6).
(5) Tighten tool T-handle and compress cover and piston (Fig. 7).
(6) Remove cover snap ring with screwdriver (Fig. 7).
(7) Remove piston cover (Fig. 8).
(8) Remove 2-4 band piston assembly (Fig. 9).

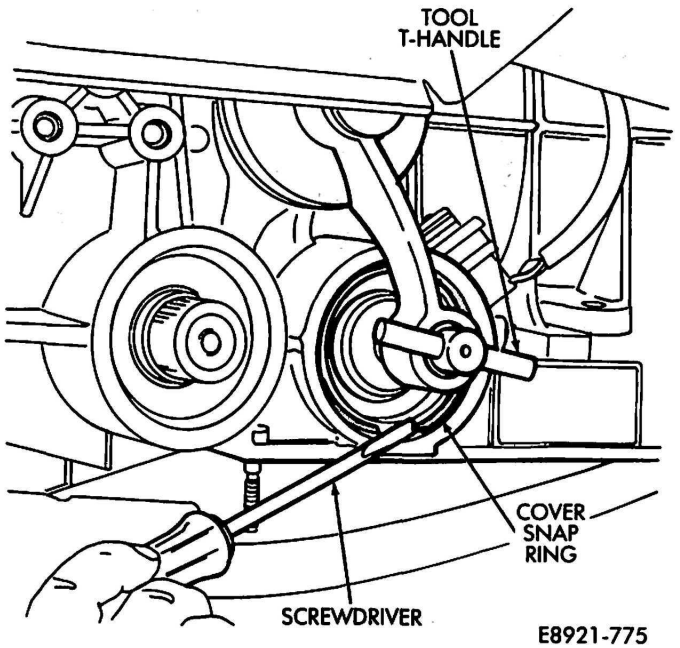


Fig. 7—Band Cover Snap Ring

(9) Remove and discard O-rings from piston and cover.
(10) Clean the piston and cover. Replace either part if worn or damaged.

2-4 Band Cover and Piston Installation

(1) Install new O-ring on piston (Fig. 10).
(2) Install new O-rings on piston cover (Fig. 11).
(3) Install piston assembly and cover in case bore. Be sure the piston rod is seated in band.

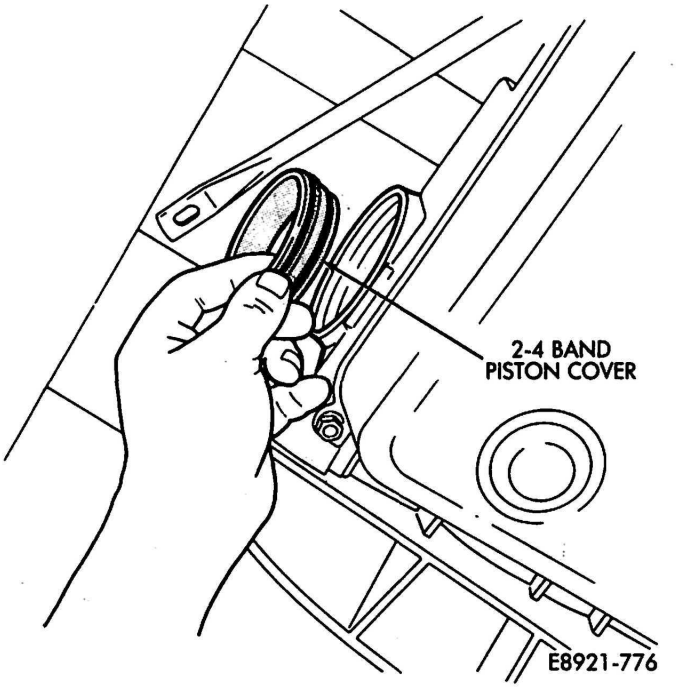


Fig. 8—2-4 Band Piston Cover

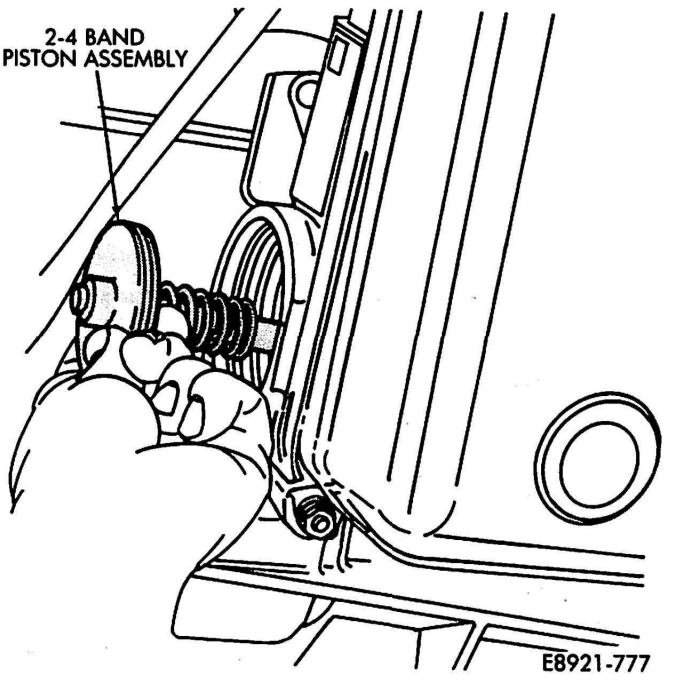


Fig. 9—2-4 Band Piston

(4) Compress piston and cover with tool 6151 and install cover snap ring (Fig. 7).

(5) Remove tool 6151 and install transmission fluid cooler (Fig. 5). Tighten cooler nut to 50 N·m (37 ft-lbs) torque.

2-4 BAND ADJUSTMENT

(1) Remove valve body as outlined in this section.

(2) Remove existing band adjusting shim (Fig. 12).

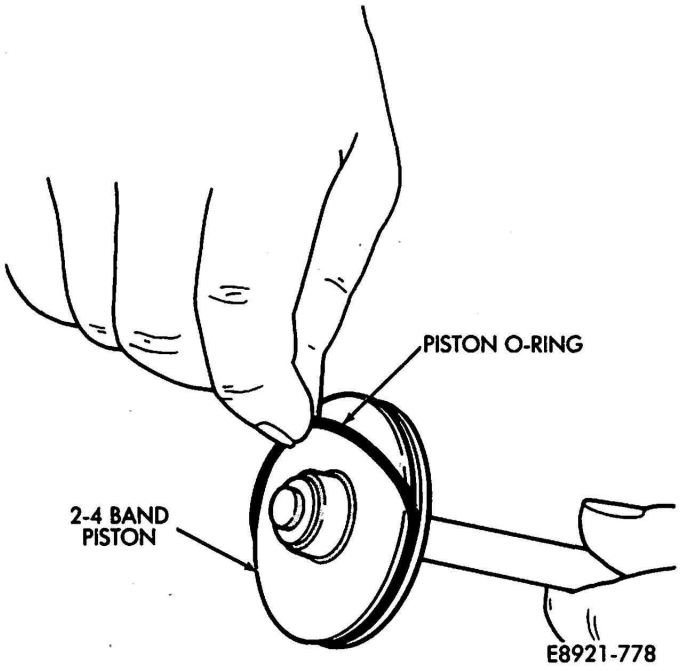


Fig. 10—Installing Band Piston O-Ring

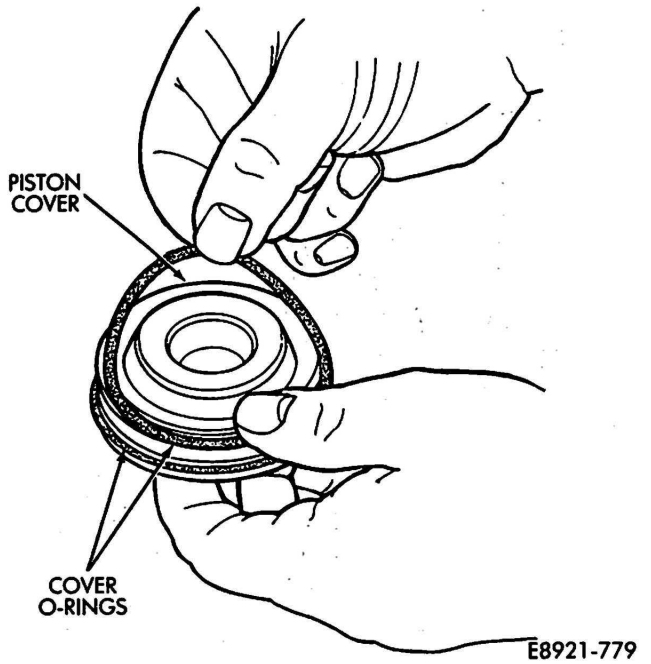


Fig. 11—Installing Band Cover O-Rings

(3) Measure and record thickness of adjusting shim.

(4) Measure clearance between band pin and case (Fig. 13). Clearance should be 1.25-1.50 mm (.049-.059 inch).

(5) If clearance must be adjusted, install thicker or thinner shim to obtain required clearance.

(6) Install the valve body as outlined in this section.

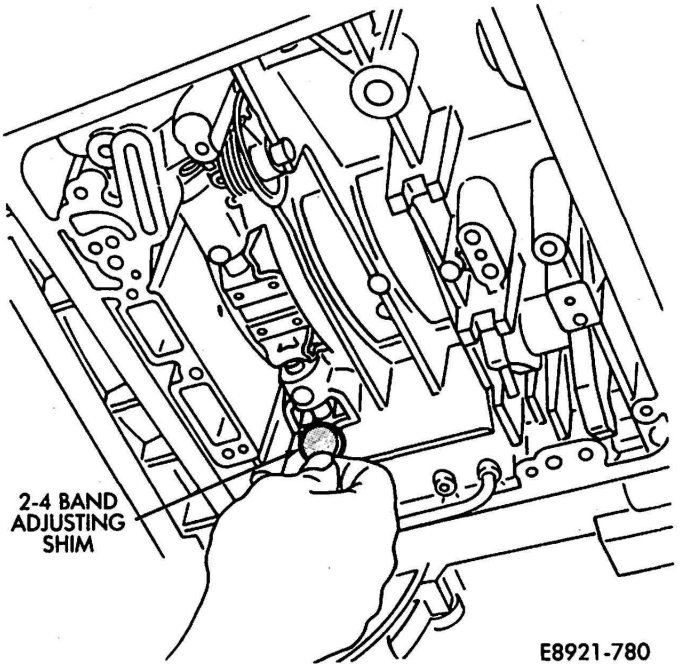


Fig. 12—2-4 Band Shim

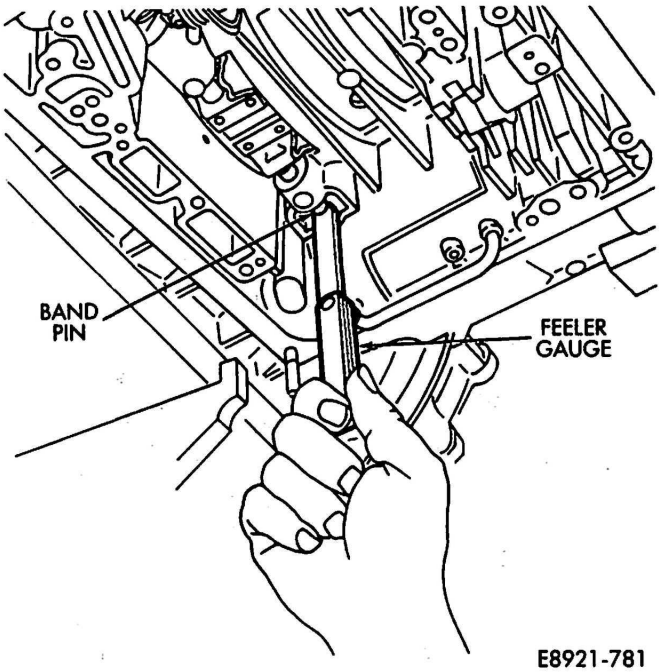


Fig. 13—Checking 2-4 Band Clearance

SPEEDOMETER SENSOR REPLACEMENT

(1) Raise vehicle and remove splash shield.
(2) Remove sensor cap bolt and washer (Fig. 14).
(3) Pull sensor out of case (Fig. 14).
(4) Cut tie strap securing sensor harness.
(5) Disconnect sensor from engine harness and remove sensor.
(6) Install and route new sensor to transmission.
(7) Secure new sensor with tie straps as necessary.

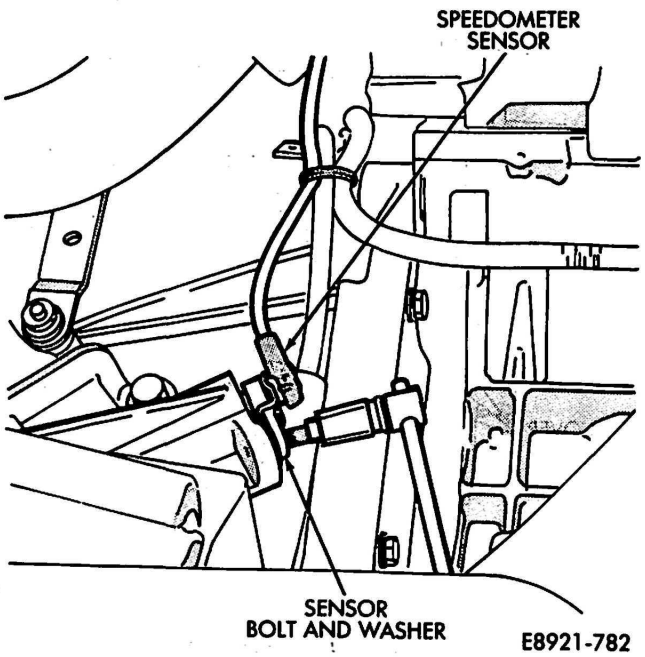


Fig. 14—Speedometer Sensor

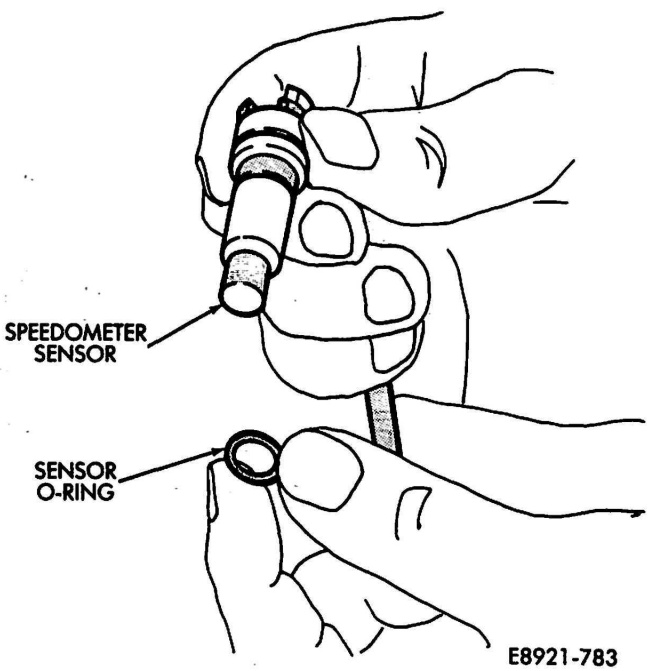


Fig. 15—Installing Sensor O-Ring

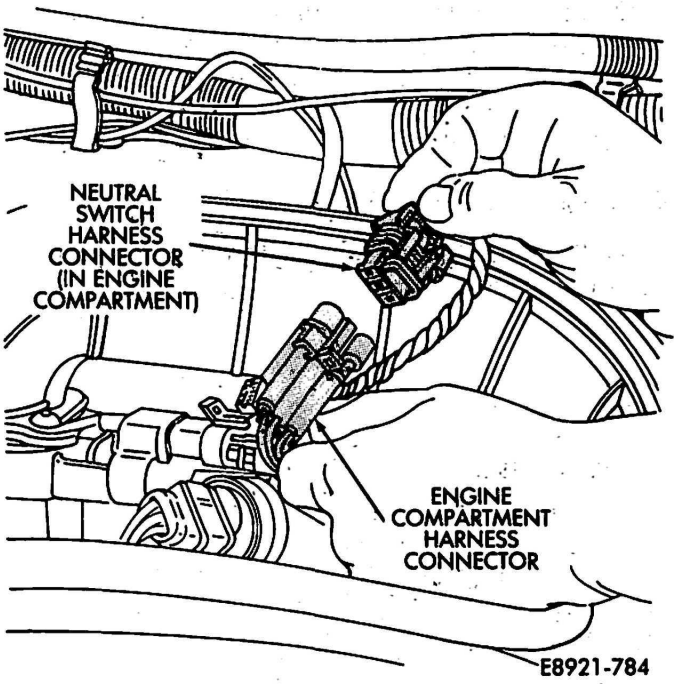


Fig. 16—Neutral Switch Harness Connector

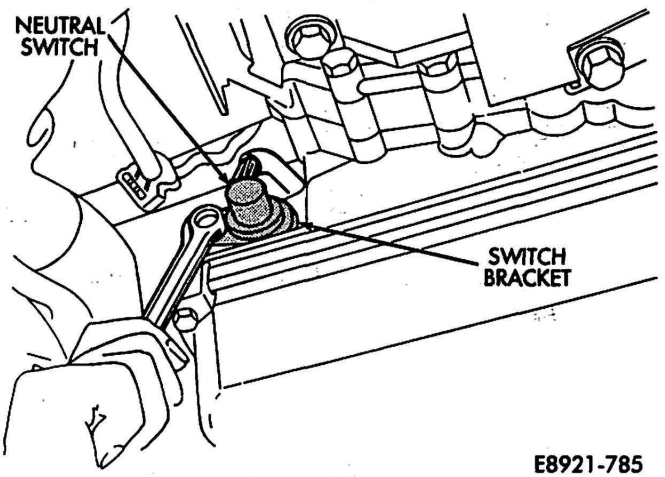


Fig. 17—Neutral Switch Removal/Installation

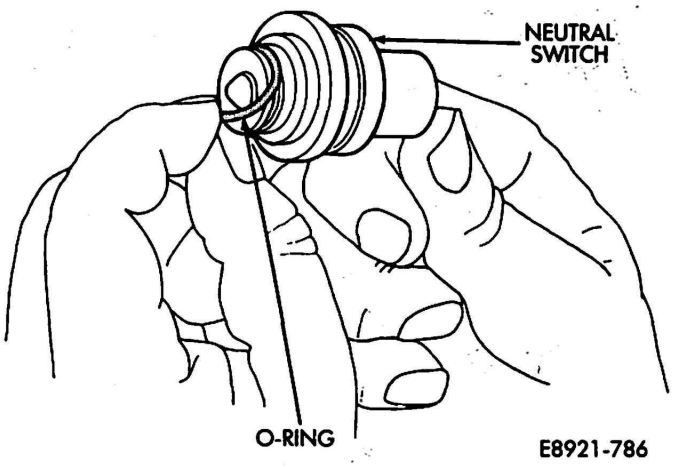


Fig. 18—Replacing Neutral Switch O-Ring

(8) Install new O-ring on sensor (Fig. 15).
(9) Install sensor in transaxle case.
(10) Install and tighten sensor bolt to 10 N·m (90 in-lbs) torque.
(11) Install splash shield and lower the vehicle.

NEUTRAL SWITCH REPLACEMENT

(1) Disconnect neutral switch harness connector in engine compartment (Fig. 16).
(2) Raise vehicle and remove splash shield.
(3) Remove bolt attaching switch bracket to transaxle case (Fig. 17).
(4) Remove neutral switch from case (Fig. 17).
(5) Remove neutral switch and harness from vehicle.
(6) Working from under vehicle, feed new switch harness up and into engine compartment.
(7) Install new O-ring on neutral switch (Fig. 18).

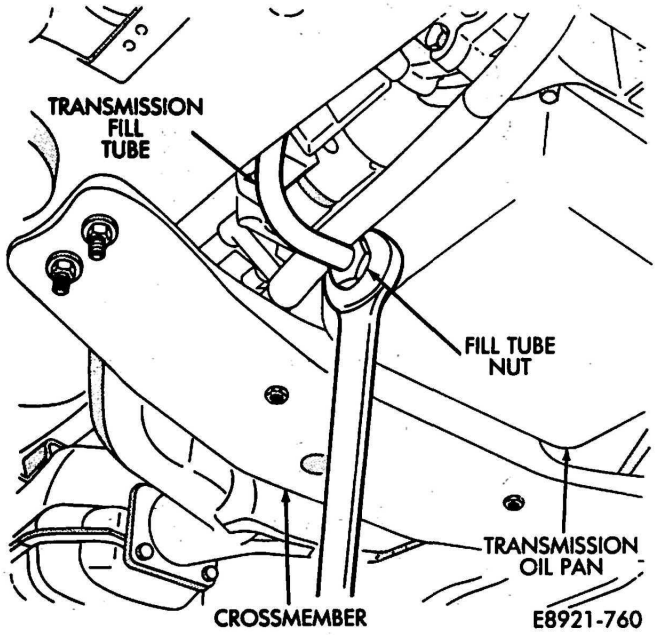


Fig. 19—Draining Transmission Fluid

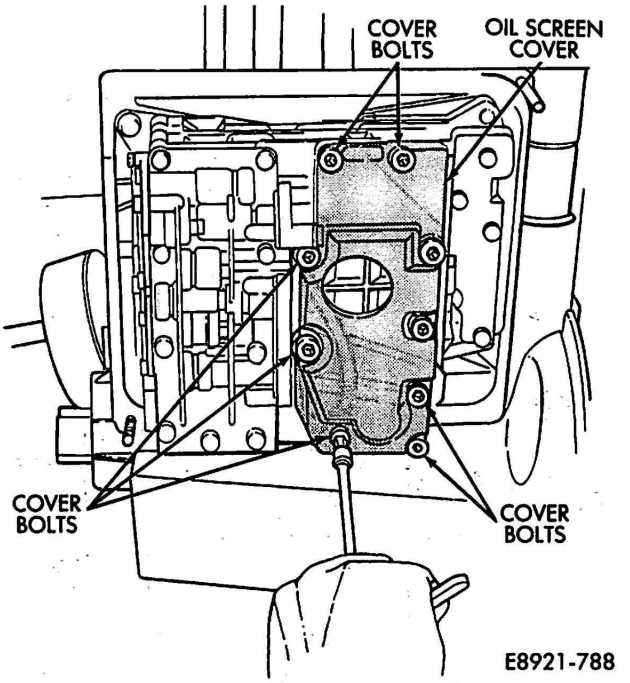


Fig. 21—Oil Screen Cover

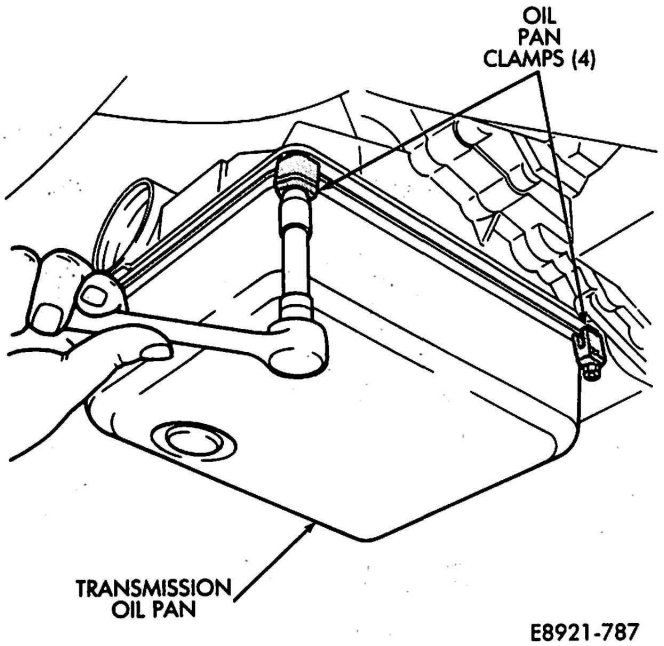


Fig. 20—Oil Pan

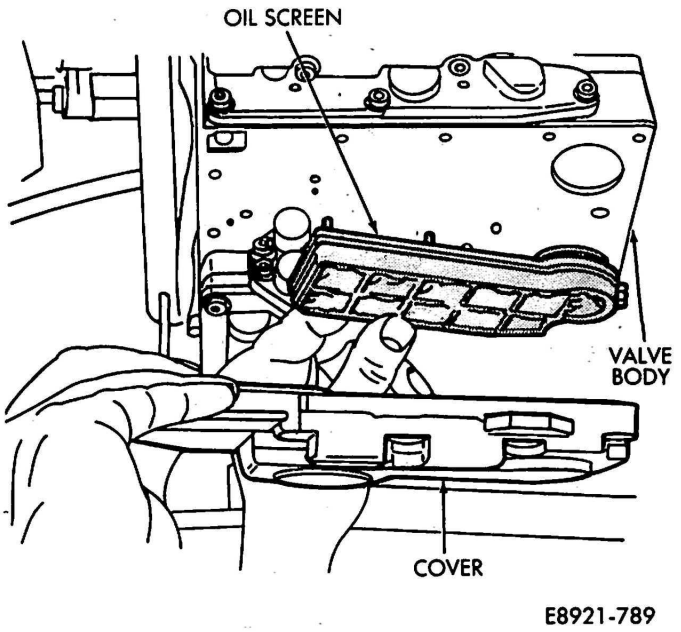


Fig. 22—Oil Screen

(8) Insert neutral switch in case.
(9) Install switch bracket and bracket bolt. Tighten bolt to 10 N·m (90 in-lbs) torque.
(10) Install splash shield and lower vehicle.
(11) Connect neutral switch harness connector to engine compartment harness connector (Fig. 16).

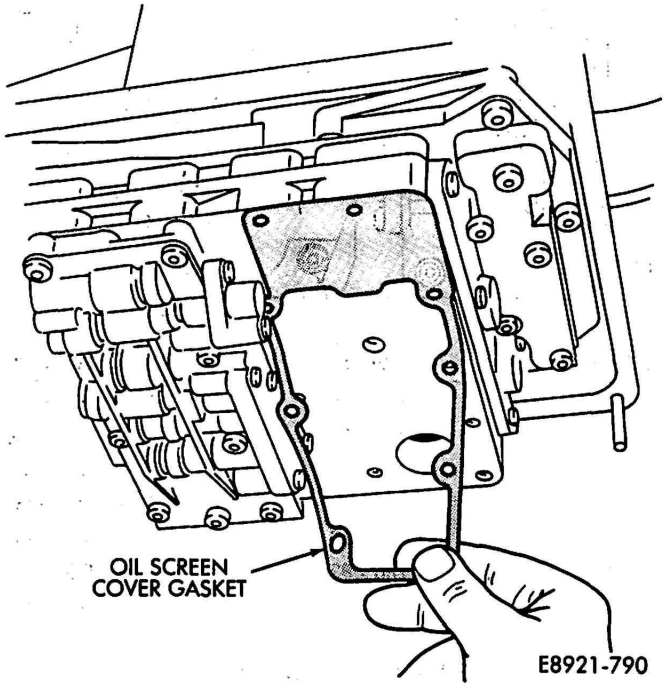


Fig. 23—Cover Gasket

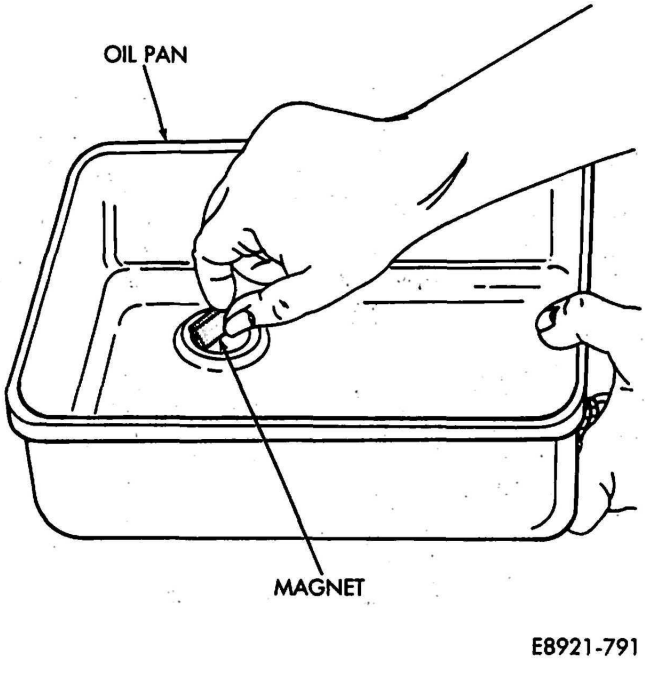


Fig. 24—Oil Pan Magnet

OIL PAN/GASKET/OIL SCREEN REMOVAL

(1) Raise vehicle and remove splash shield.
(2) Loosen nut attaching fill tube to pan and drain the transmission fluid (Fig. 19).
(3) Completely disconnect fill tube from pan after all fluid has drained.
(4) Remove nuts that secure oil pan clamps to pan and case (Fig. 20) and remove pan and clamps.
(5) Remove oil screen cover bolts and remove cover (Fig. 21).
(6) Remove oil screen from valve body (Fig. 22). Remove and discard old O-ring seal from screen.
(7) Remove oil screen cover gasket (Fig. 23).
(8) Remove old gasket from oil pan and remove magnet from bottom of pan (Fig. 24).

OIL PAN/GASKET/OIL SCREEN INSTALLATION

(1) Clean oil pan and screen. Replace screen if damaged.
(2) Install magnet in oil pan (Fig. 24). Magnet goes in circular indentation in pan.
(3) Install new gasket on oil pan (Fig. 25). Do not use sealer on pan.
(4) Install new O-ring on oil screen (Fig. 26).
(5) Coat new oil screen gasket with petroleum jelly and install it on valve body (Fig. 23).
(6) Install oil screen. Be sure oil screen tabs are seated in valve body (Fig. 27).
(7) Install oil screen cover (Fig. 27).
(8) Verify that oil screen gasket and cover are aligned.
(9) Install oil screen cover bolts finger tight.

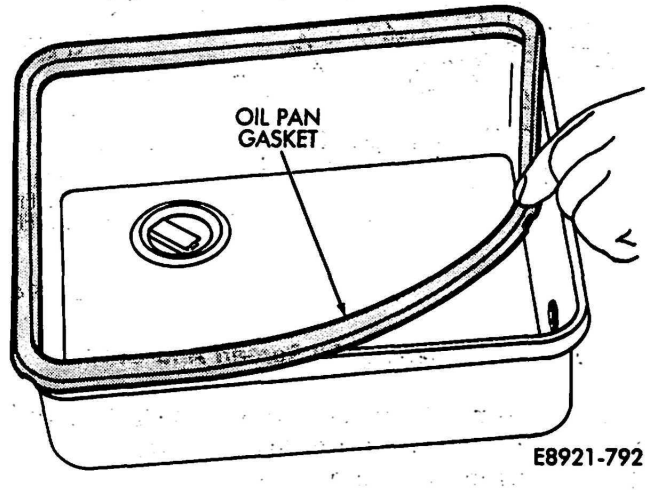


Fig. 25—Installing Oil Pan Gasket

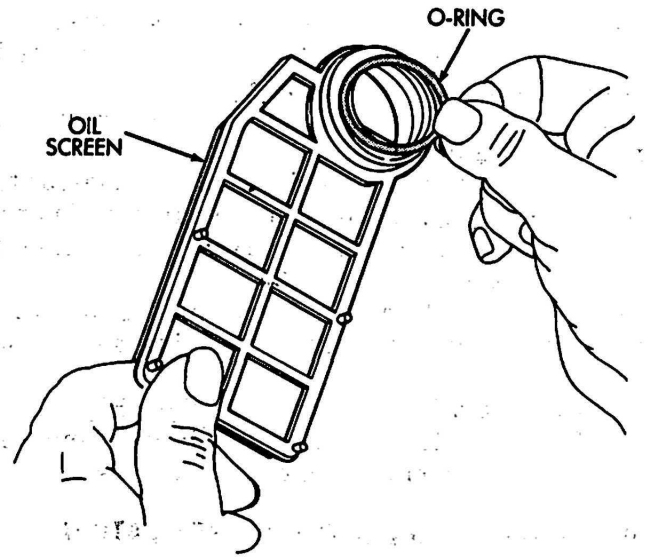


Fig. 26—Installing Oil Screen O-Ring

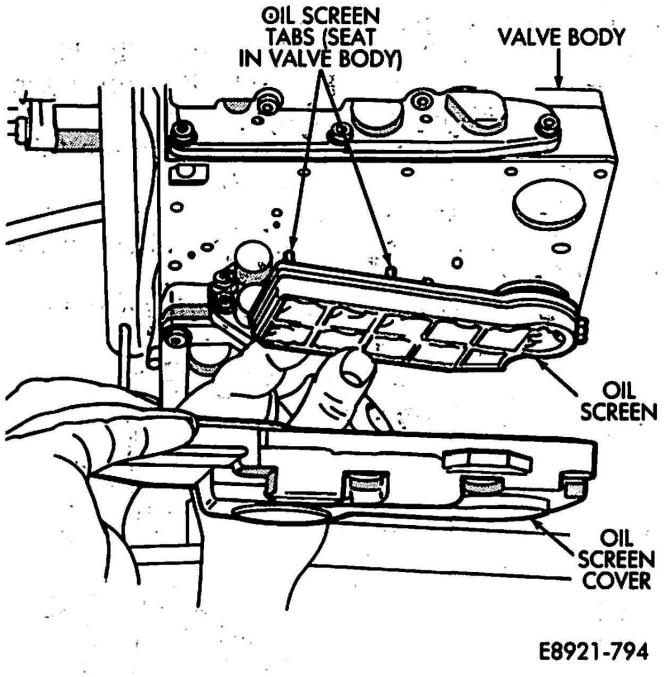
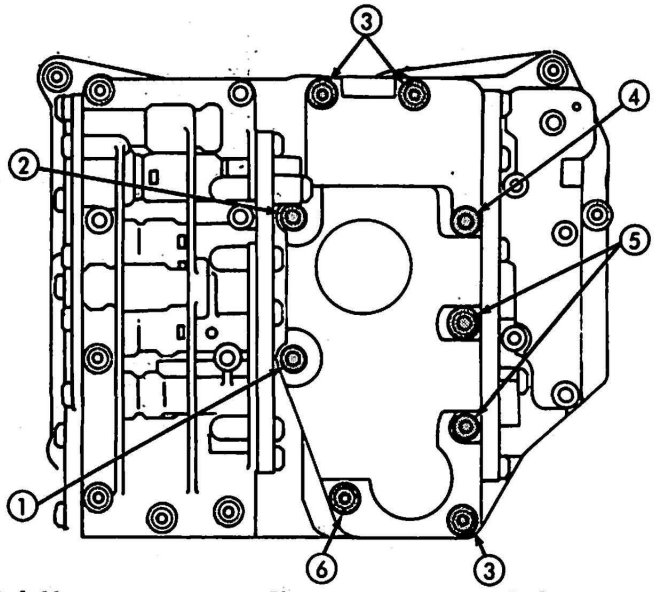


Fig. 27—Installing Oil Screen And Cover

(10) Tighten oil screen bolts to torque specification indicated in bolt chart (Fig. 28).

(11) Position oil pan on case.



Bolt No.	Size	Bolt Torque
1	M5×65	5 N·m (45 in-lbs)
2	M5×85	5 N·m (45 in-lbs)
3	M6×75	8 N·m (72 in-lbs)
4	M5×80	5 N·m (45 in-lbs)
5	M5×60	5 N·m (45 in-lbs)
6	M6×83	8 N·m (72 in-lbs)

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Fig. 28—Oil Screen Bolt Chart

(12) Install pan retaining clamps and tighten clamp nuts to 6 N·m (54 in-lbs) torque.

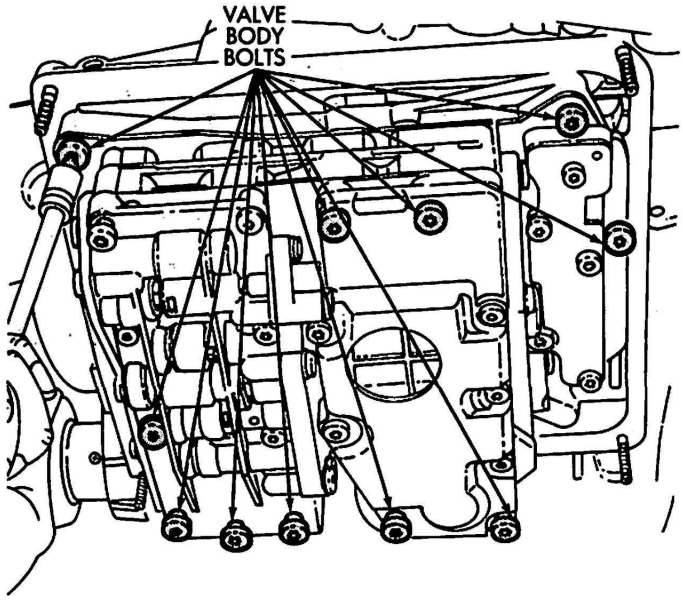


Fig. 29—Valve Body Bolt Locations

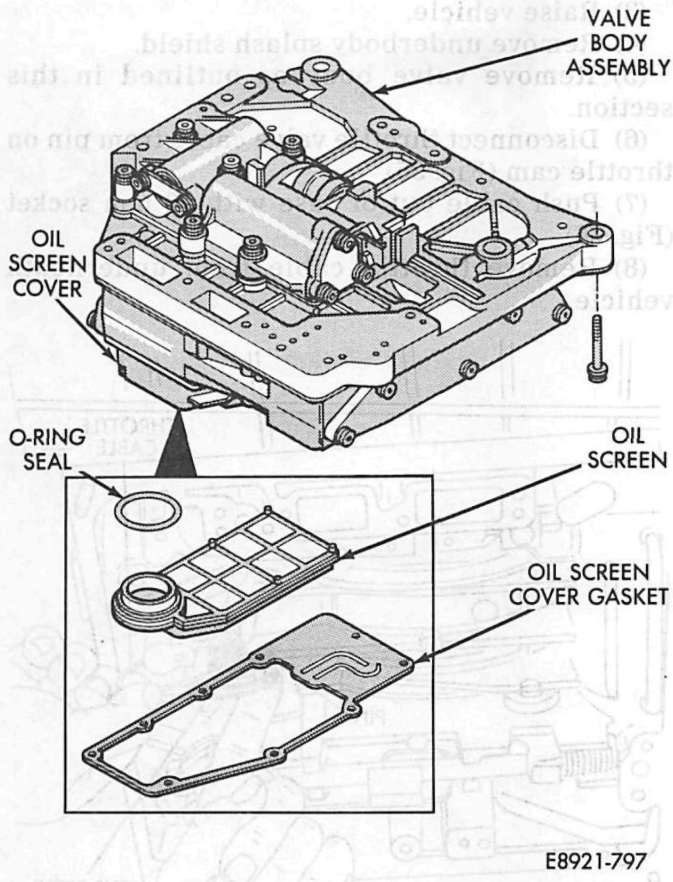


Fig. 30—Valve Body And Oil Screen

(13) Connect fill tube to oil pan. Tighten oil tube retaining nut to 100 N·m (74 ft-lbs) torque.

(14) Install splash shield and lower vehicle.

(15) Fill transmission with Mercon™ transmission fluid.

VALVE BODY REMOVAL

(1) Shift transmission into manual first gear range.

(2) Raise vehicle.

(3) Remove underbody splash shield.

(4) Remove oil pan.

(5) Remove valve body bolts (Fig. 29).

(6) Remove valve body assembly (Fig. 30).

(7) Remove oil screen cover, gasket and oil screen if these components require service (Fig. 30).

VALVE BODY INSTALLATION

(1) Move selector lever counterclockwise into manual first gear detent (Fig. 31). **This is last detent in counterclockwise direction.**

(2) Pull throttle cable to wide open throttle position. This is necessary to avoid jamming throttle cam and piston when valve body is installed.

(3) Push manual valve all the way in to manual first gear position (Fig. 32).

(4) Align and install valve body on case (Fig. 32).

(5) Install and tighten valve body bolts to torque specified in chart (Fig. 33). Be sure correct length bolt is installed at each location. Refer to Figure 33.

(6) Install oil pan.

(7) Install splash shield and lower vehicle.

(8) Fill transmission with Mercon™ transmission fluid.

(9) Adjust throttle cable.

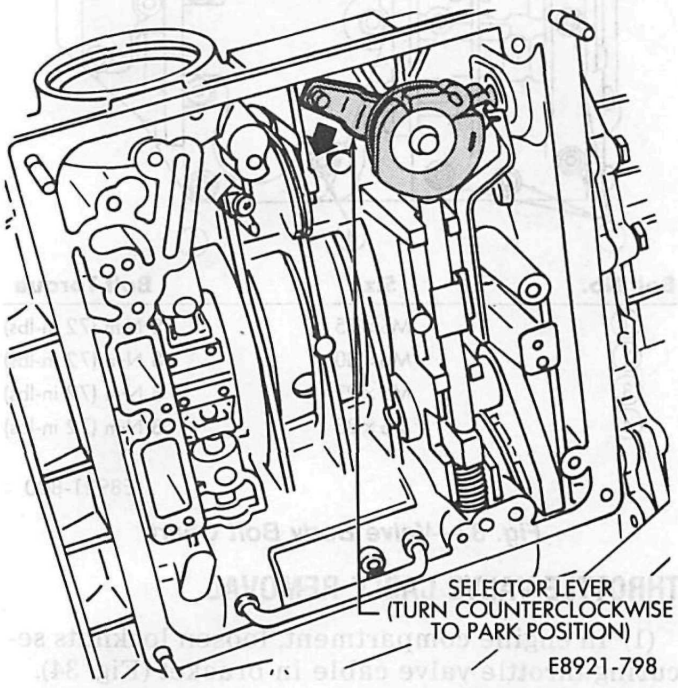


Fig. 31—Shift Selector Lever

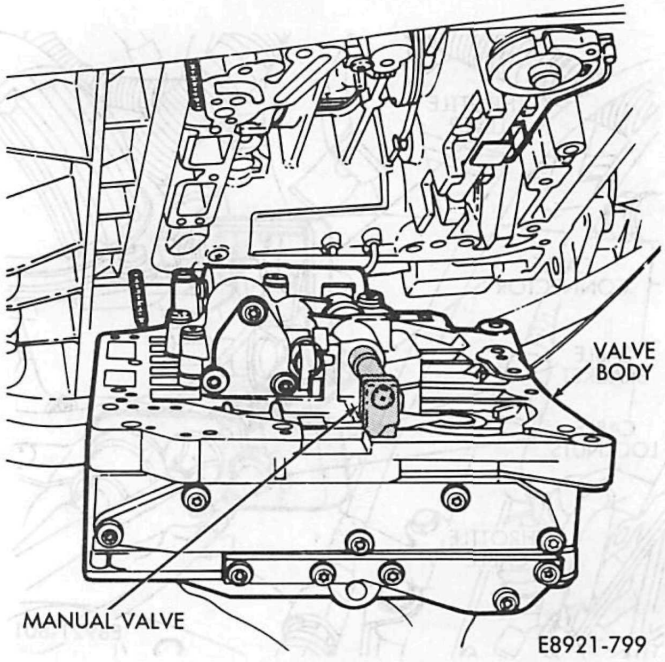
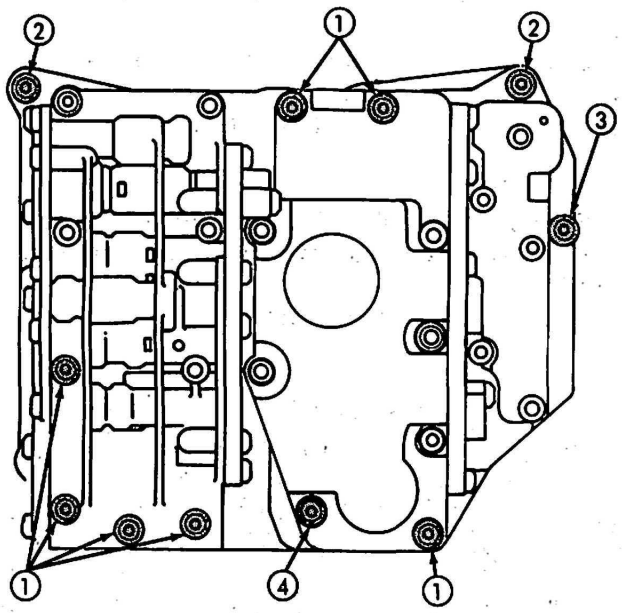


Fig. 32—Valve Body Installation



Bolt No.	Size	Bolt Torque
①	M6×75	8 N·m (72 in-lbs)
②	M6×30	8 N·m (72 in-lbs)
③	M6×27	8 N·m (72 in-lbs)
④	M6×83	8 N·m (72 in-lbs)

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Fig. 33—Valve Body Bolt Chart

THROTTLE VALVE CABLE REMOVAL

(1) In engine compartment, loosen locknuts securing throttle valve cable in bracket (Fig. 34).

(2) Disconnect cable at throttle lever and lift cable out of bracket (Fig. 34).

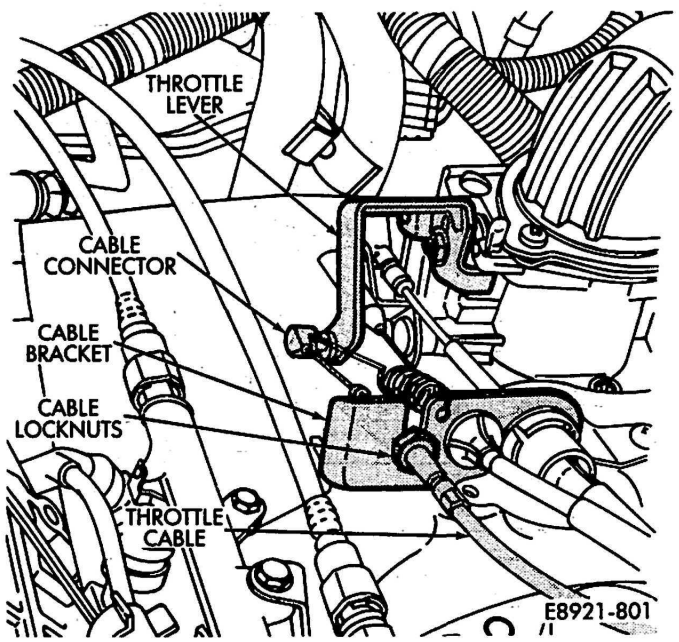


Fig. 34—Throttle Valve Cable Attachment

(3) Raise vehicle.

(4) Remove underbody splash shield.

(5) Remove valve body as outlined in this section.

(6) Disconnect throttle valve cable from pin on throttle cam (Fig. 35).

(7) Push cable out of case with 10 mm socket (Fig. 36).

(8) Remove throttle cable from underneath vehicle.

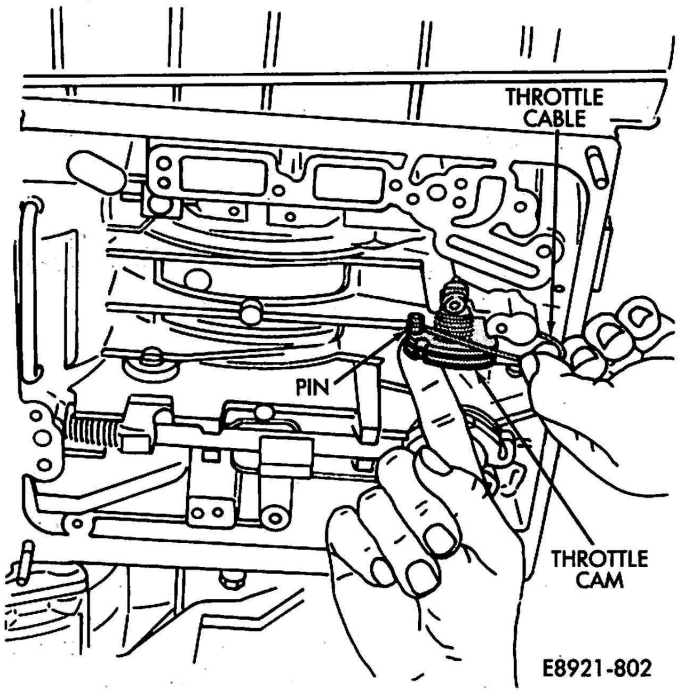


Fig. 35—Disconnect Throttle Cable at Cam

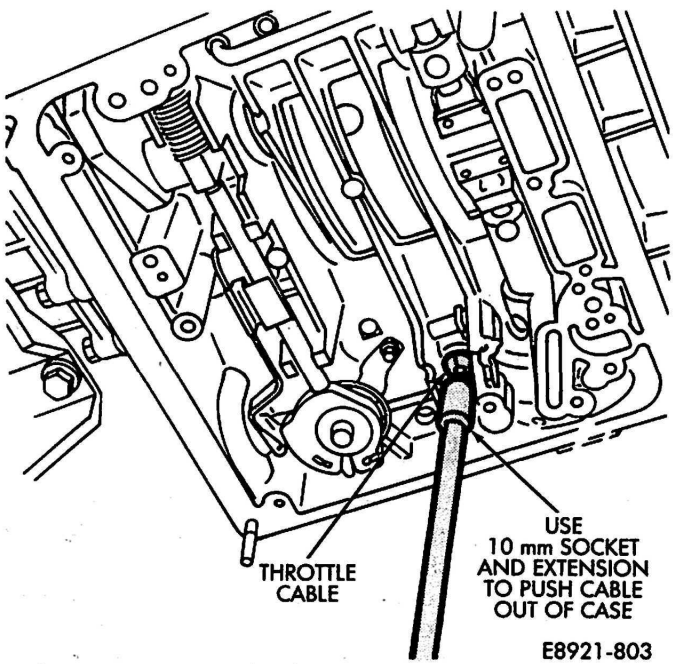


Fig. 36—Removing Throttle Valve Cable From Case

THROTTLE VALVE CABLE INSTALLATION

(1) Install new O-ring on cable (Fig. 37). Lubricate O-ring with transmission fluid or petroleum jelly.
(2) Insert cable into transmission case.
(3) Connect cable to throttle cam (Fig. 35).
(4) Install valve body as outlined in this section.
(5) Install splash shield and lower vehicle.
(6) In engine compartment, connect throttle cable to throttle lever and cable bracket (Fig. 34).
(7) Adjust throttle valve cable. Refer to procedure in this section.

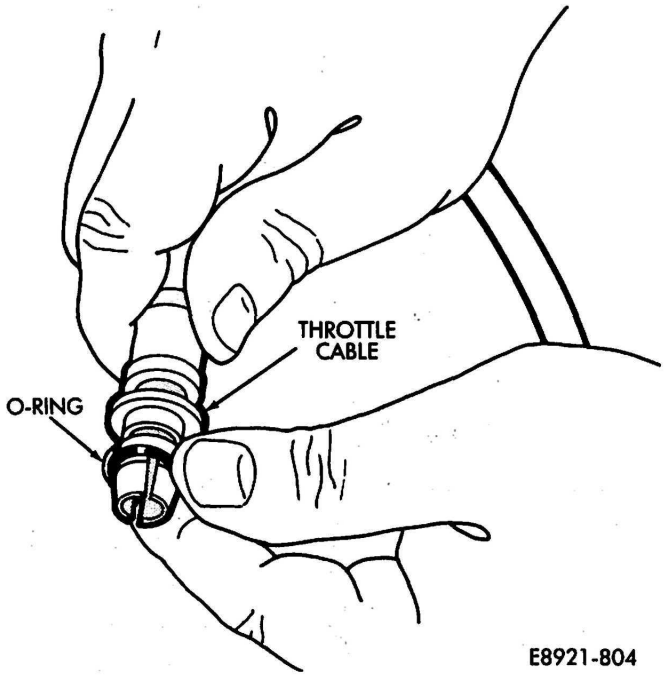


Fig. 37—Replacing Throttle Valve Cable O-Ring

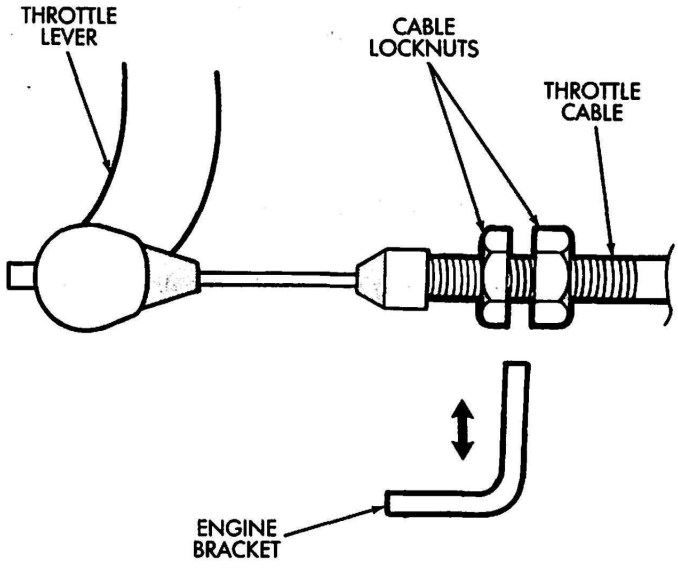


Fig. 38—Removing Cable From Engine Bracket

THROTTLE VALVE CABLE ADJUSTMENT

(1) Loosen cable locknuts and lift threaded shank of cable out of engine bracket (Fig. 38).
(2) Place throttle lever in curb idle position.
(3) If accurate vernier calipers are not available in shop, fabricate a cable adjustment gauge that can be slipped over the throttle cable wire. Gauge length must be 39.5 mm (1.55 inches) long (Fig. 39).

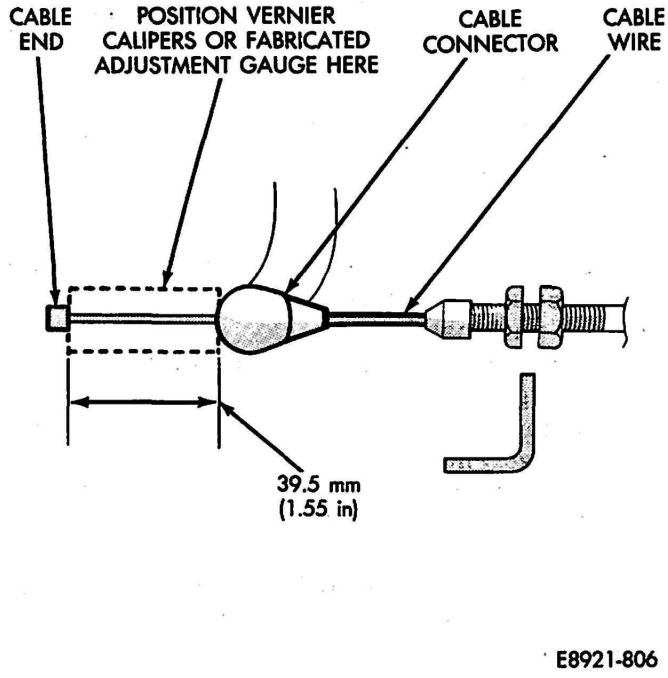


Fig. 39—Setting Cable Adjustment

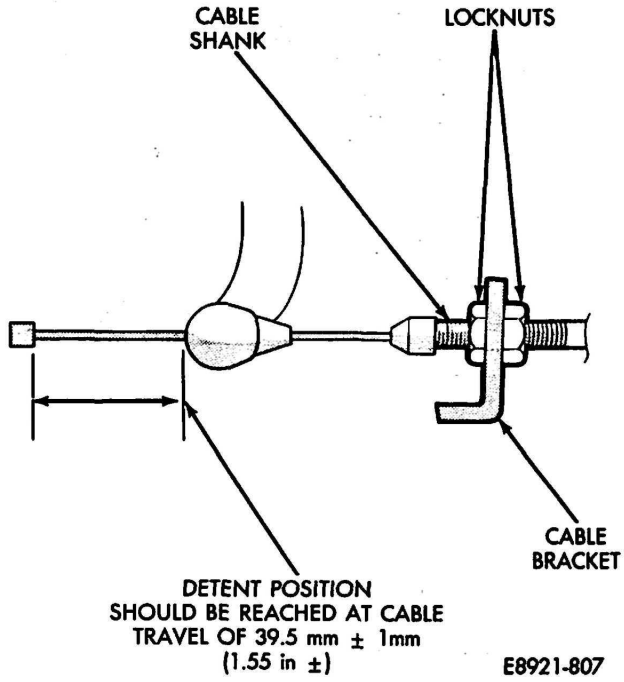


Fig. 40—Verifying Throttle Cable Adjustment

(4) Pull cable wire foreward and position vernier calipers (or fabricated gauge) on wire between cable connector and cable end (Fig. 39).

(5) Pull cable shank rearward to detent position but not to wide open throttle position (detent position feels similar to stop when reached).

(6) Hold cable shank at detent position. Then insert shank in cable bracket and tighten cable locknuts (Fig. 40).

(7) Remove vernier calipers or gauge and verify adjustment (Fig. 40). Cable detent position should be reached when cable wire travels 39.5 mm ± 1 mm (1.55 inch ± .039 inch).

THROTTLE CAM/GEAR SELECTOR/PARK LOCK COMPONENT REMOVAL

(1) Remove valve body.

(2) Remove reduction gear case as described in this section. Gear case must be removed for access to park pawl pin.

(3) Disconnect throttle valve cable from throttle cam (Fig. 35).

(4) Remove throttle cam attaching bolt and remove cam assembly (Fig. 41).

(5) Disconnect and remove transmission shift lever (Fig. 42). Discard the shift lever nut. It is not reusable.

(6) Press park pawl spring to one side with screwdriver. Then remove gear selector with rotating motion (Fig. 43).

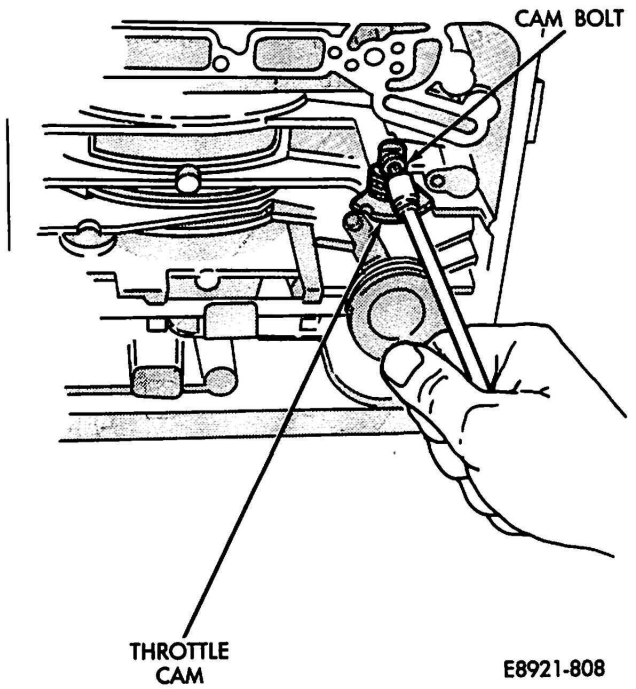


Fig. 41—Removing Throttle Cam

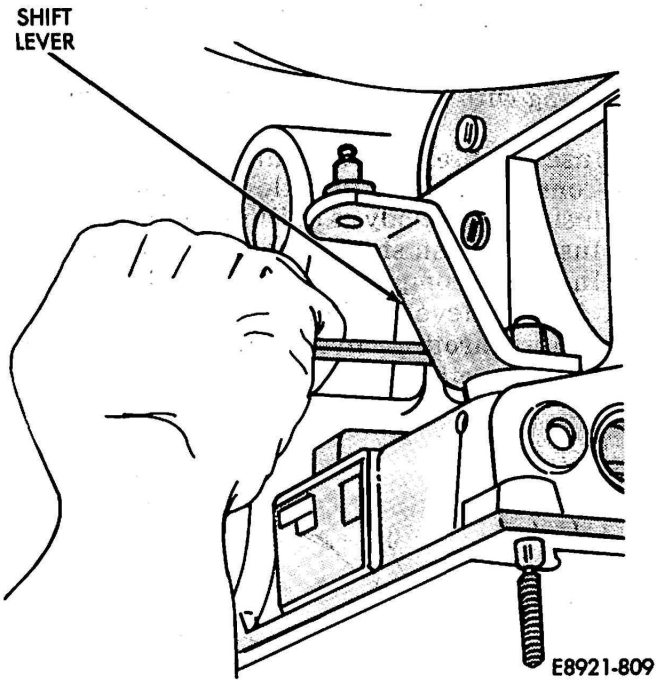


Fig. 42—Shift Lever

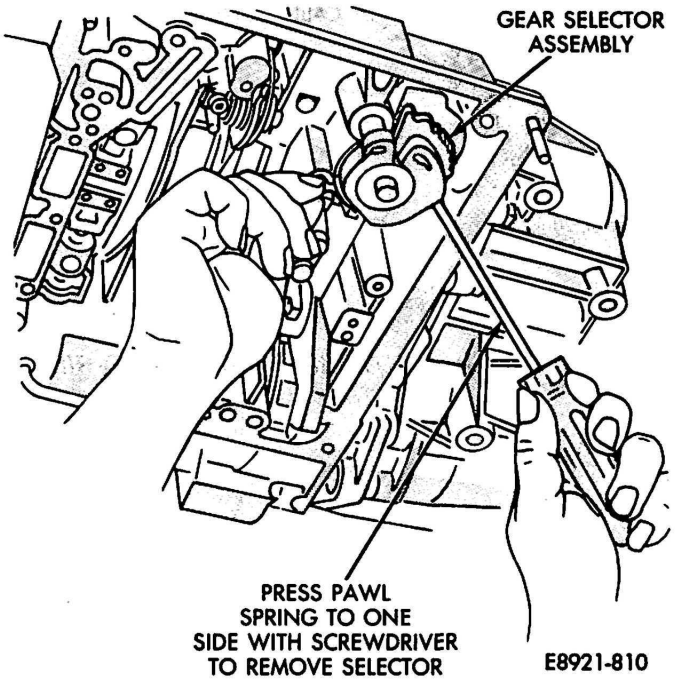


Fig. 43—Removing Gear Selector Assembly

(7) Remove clamp and remove connecting rod (Fig. 44).

(8) Remove detent spring attaching screws and remove spring (Fig. 45). Spring positioning pin will normally remain in case (Fig. 45). However, if pin is loose, remove it with pliers and set it aside for assembly.

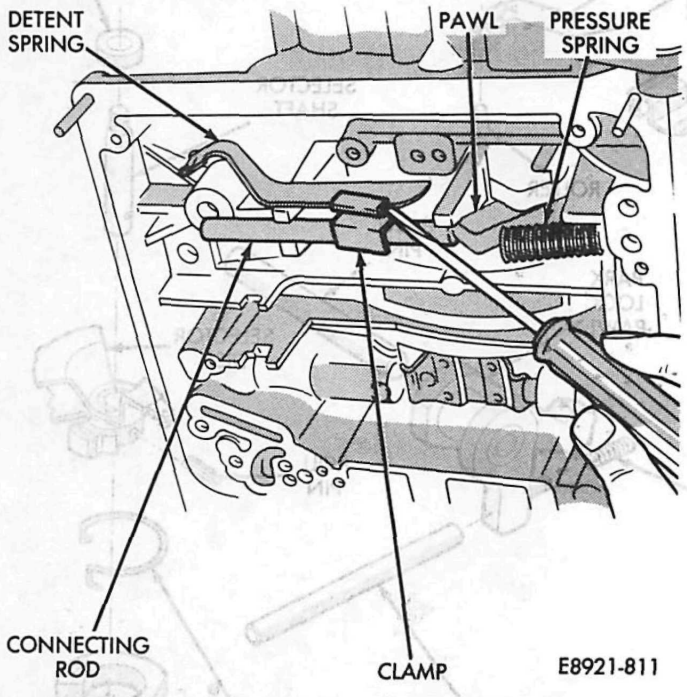


Fig. 44—Removing Clamp And Connecting Rod

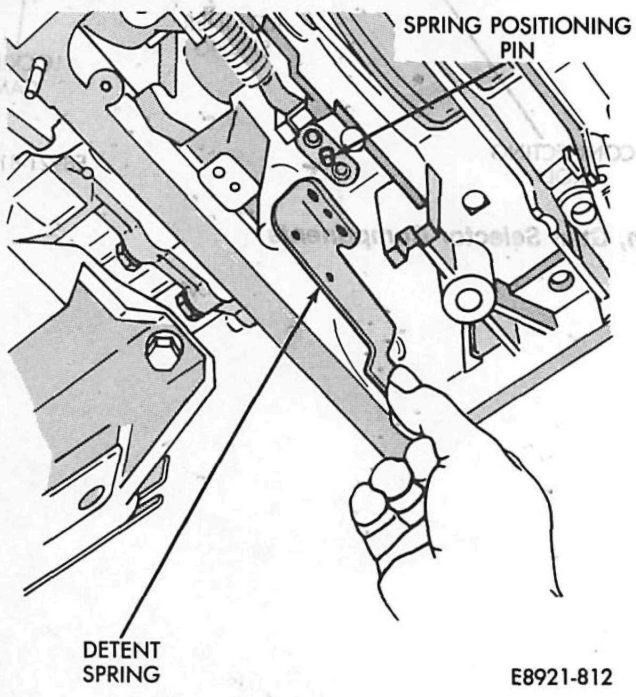


Fig. 45—Detent Spring And Positioning Pin

(9) Remove park pawl pressure spring (Fig. 46).

(10) Remove park pawl pin and remove park pawl (Fig. 47).

(11) Disassemble gear selector assembly if it requires service (Fig. 48).

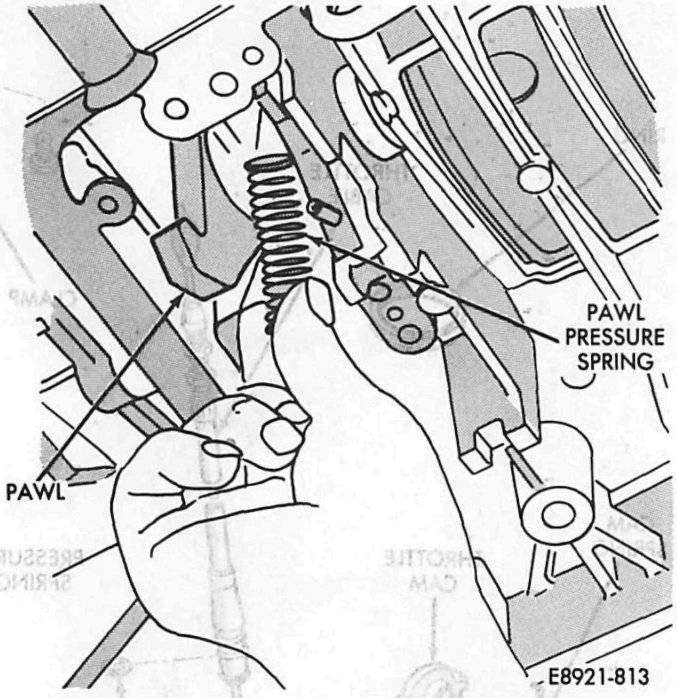


Fig. 46—Removing Park Pawl Pressure Spring

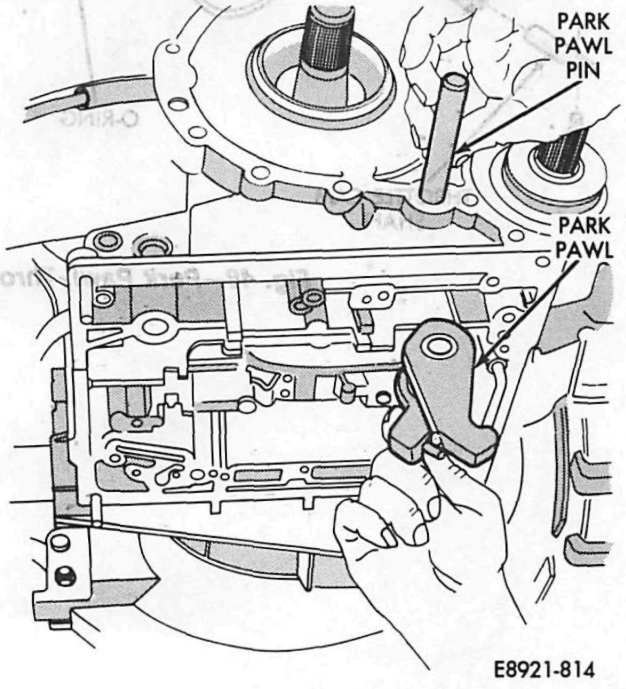


Fig. 47—Park Pawl And Pin

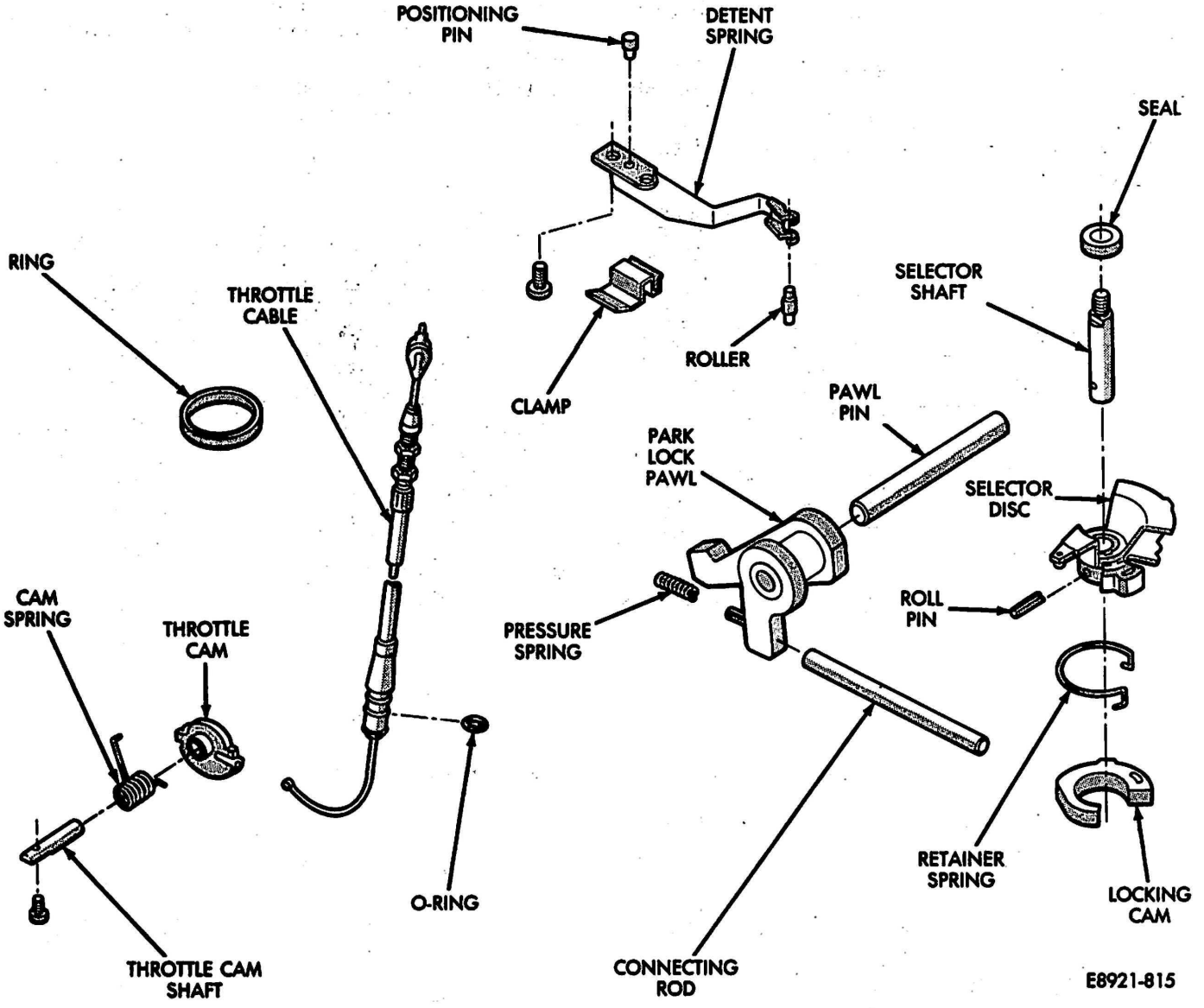


Fig. 48—Park Pawl, Throttle Cam, Gear Selector Components

THROTTLE CAM/GEAR SELECTOR/PARK LOCK COMPONENT INSTALLATION

(1) Install park pawl pin (Fig. 47).

(2) Assemble gear selector (Figs. 48 and 49). Hook ends of retainer spring in slots of locking cam and selector disc and seat cam on disc (Fig. 49). Set assembly aside—do not install it at this time.

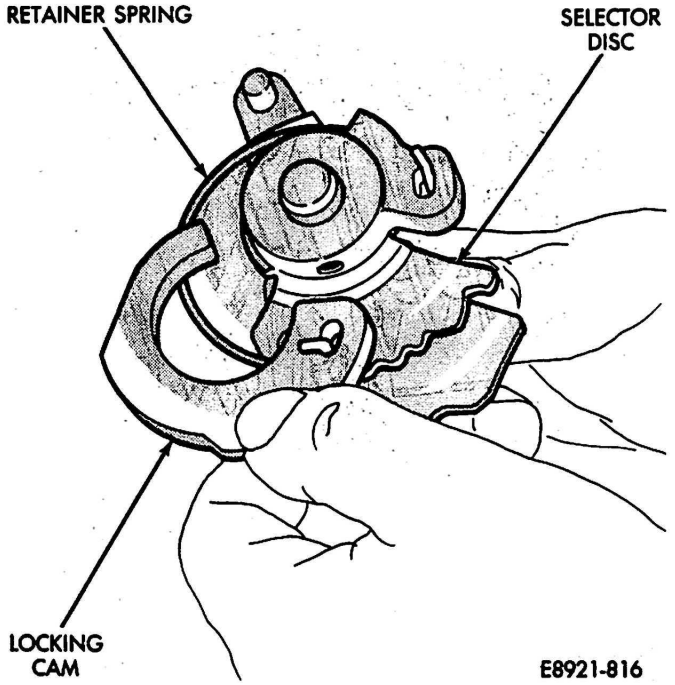


Fig. 49—Locking Cam And Retainer Spring

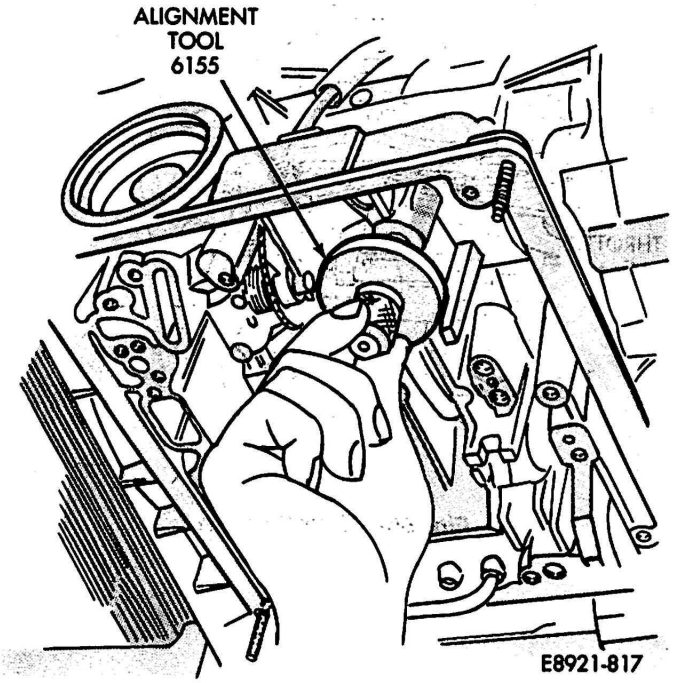


Fig. 50—Detent Spring Alignment Tool

(3) Install detent spring alignment tool 6155 in gear selector shaft hole (Fig. 50).

(4) Install positioning pin if removed (Fig. 51).

(5) Install detent spring on positioning pin (Fig. 52). Press and hold spring against alignment tool 6155 and install spring attaching screws. Tighten screws to 10 N·m (90 in-lbs) torque.

(6) Remove alignment tool 6155.

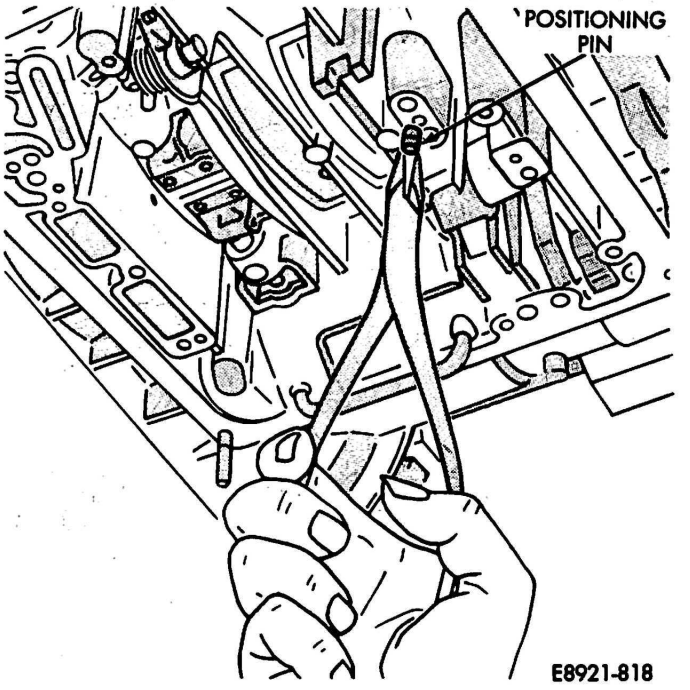


Fig. 51—Positioning Pin

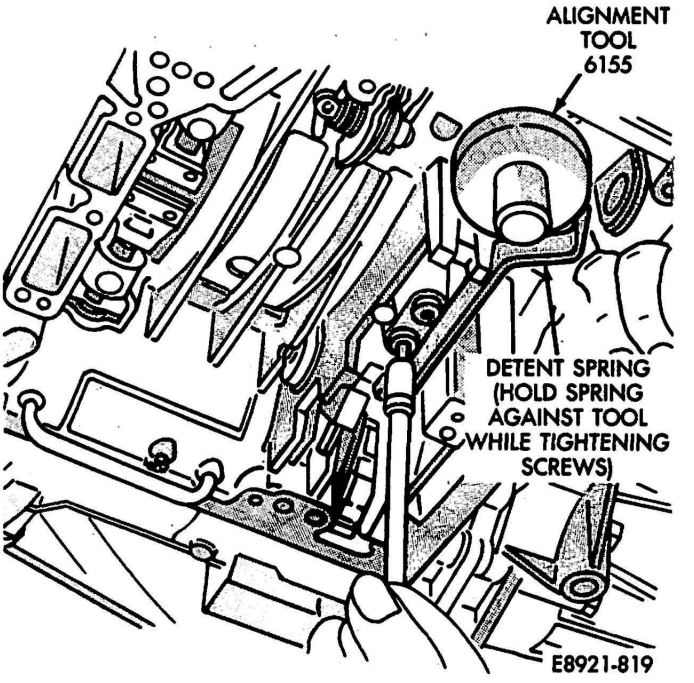


Fig. 52—Detent Spring

(7) Install gear selector assembly. Push detent spring aside with screwdriver and seat selector assembly (Fig. 53).

(8) Install connecting rod and pawl pressure spring. Place spring on pawl slot pin and install rod (Fig. 54).

(9) Install connecting rod clamp (Fig. 55). Push clamp into place with screwdriver.

(10) Install throttle cam (Fig. 56). Tighten cam attaching bolt to 5 N·m (45-in-lbs) torque.

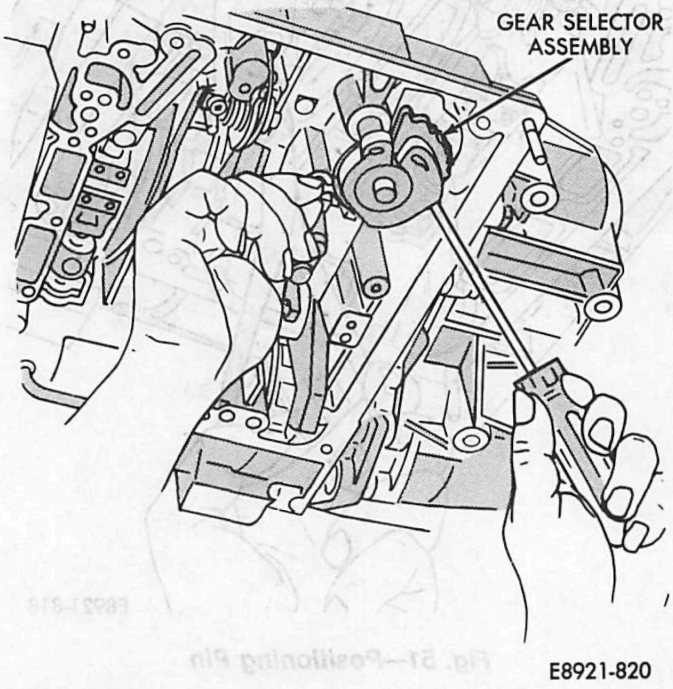


Fig. 53—Gear Selector Assembly

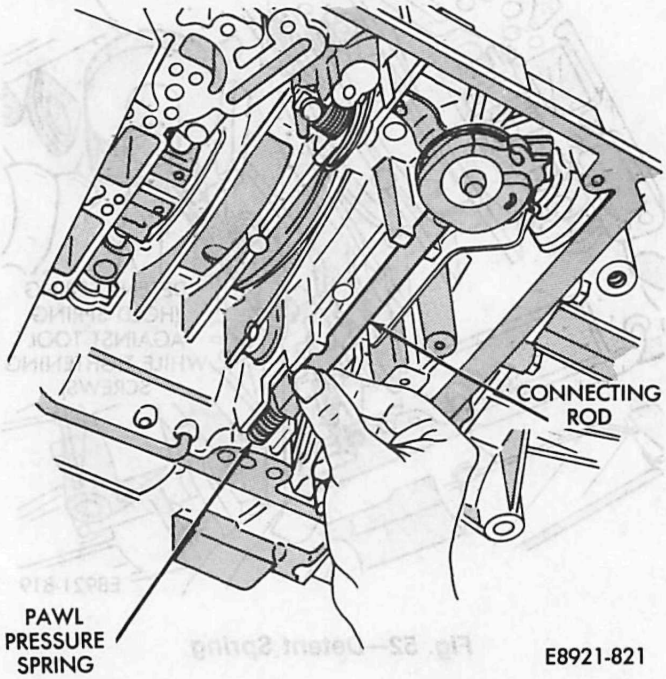


Fig. 54—Connecting Rod And Pressure Spring

(11) Connect throttle cable to throttle cam (Fig. 57).

(12) Install the transmission shift lever. Tighten the lever retaining nut to 17 N·m (12.5 ft-lbs) torque. Secure the lever with a new retaining nut. The nut is a one-time use item and is not reusable.

(13) Install reduction gear case.

(14) Install the valve body and oil screen.

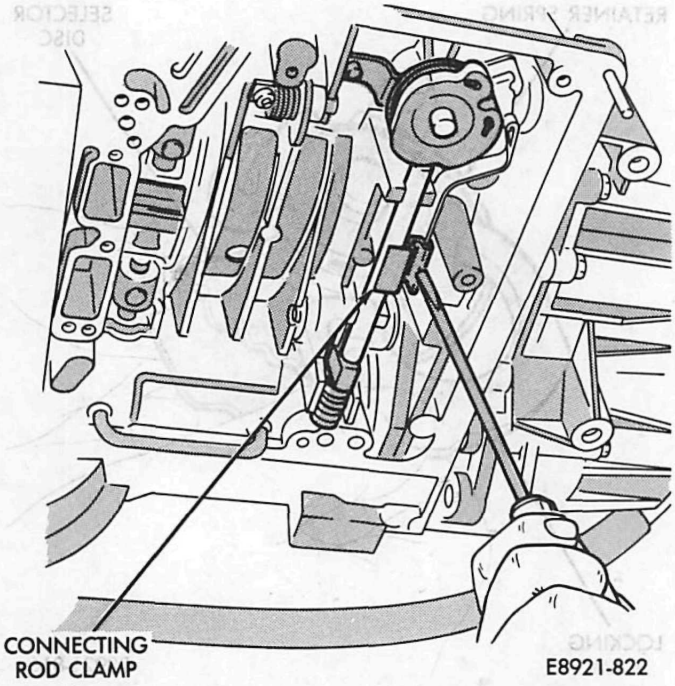


Fig. 55—Connecting Rod Clamp

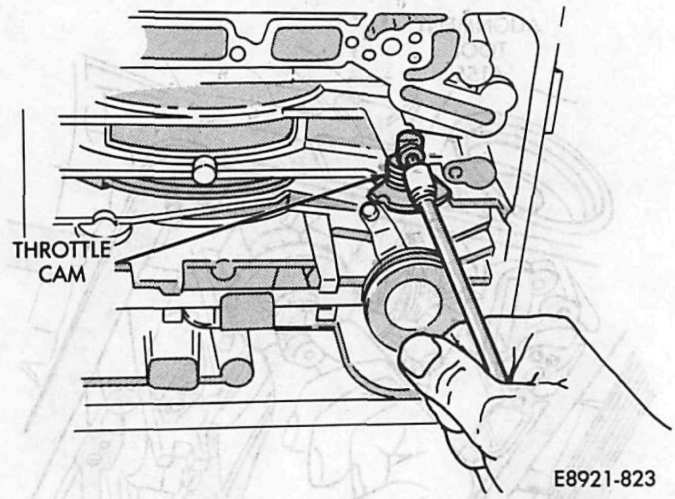


Fig. 56—Throttle Cam

REDUCTION GEAR CASE/GOVERNOR/GOVERNOR SUPPORT SERVICE

If the governor and/or support require service, the reduction gear case must be removed for access to the governor support.

Reduction Gear Case Removal

(1) Raise vehicle.
(2) Remove underbody splash shield.
(3) Disconnect exhaust pipes.
(4) Remove differential drain plug and drain lubricant (Fig. 58).
(5) Remove bolts attaching reduction gear case to transaxle.

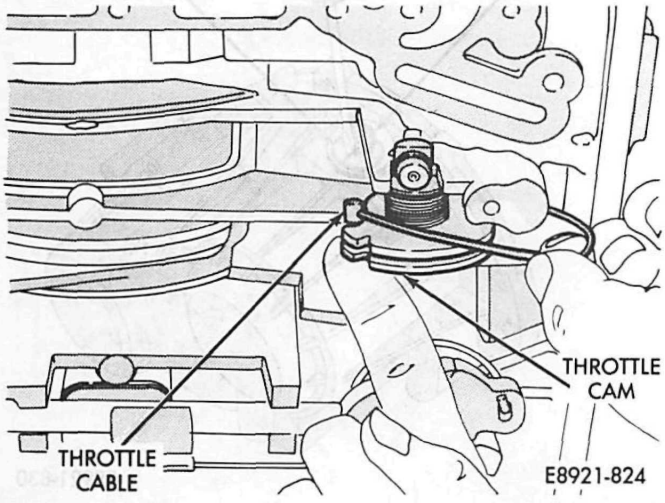


Fig. 57—Connecting Throttle Cable to Cam

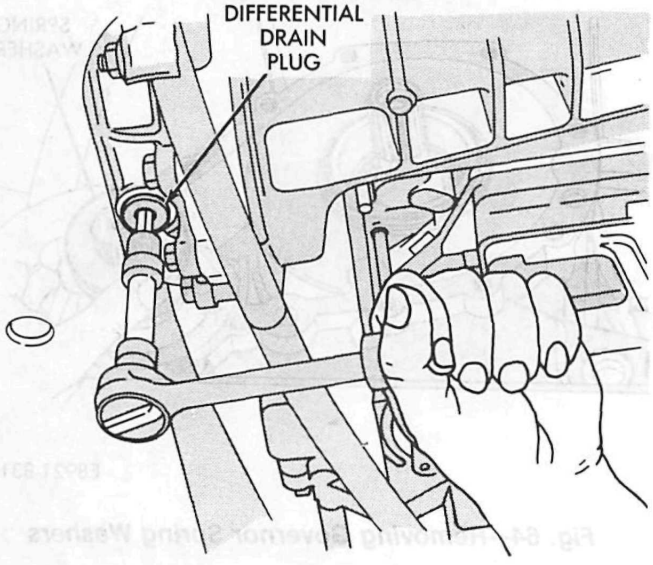


Fig. 58—Differential Drain Plug

(6) Carefully remove reduction gear case (Fig. 59). Do not disturb position of shims or spring washers during removal. Keep shims/washers together.
(7) Remove gear case gasket (Fig. 60).
(8) Remove bearing plate bolts and remove plat from main case (Fig. 61). Keep any bearing shims together and in same order as removed.

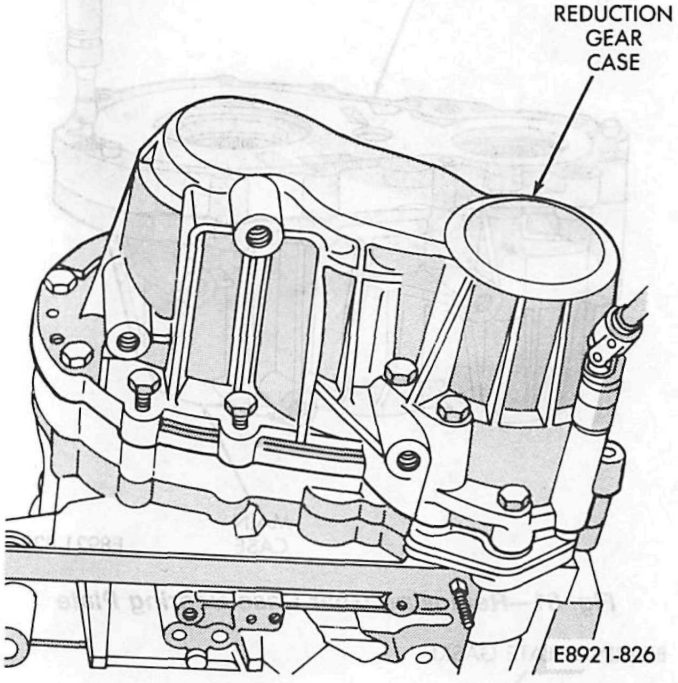


Fig 59—Reduction Gear Case

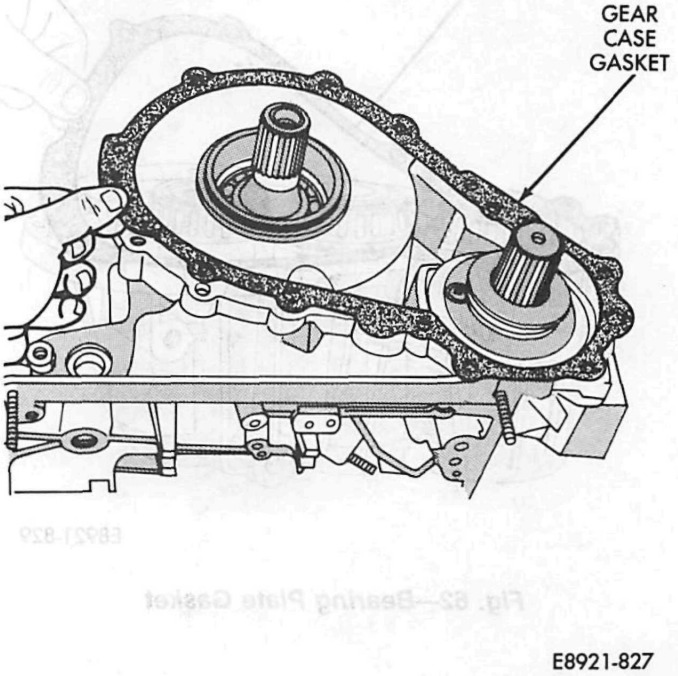


Fig. 60—Removing Gear Case Gasket

(9) Remove bearing plate gasket (Fig. 62).
(10) Remove cover from gear case breather.
(11) Remove vent retaining clip and remove gear case vent (Fig. 63).

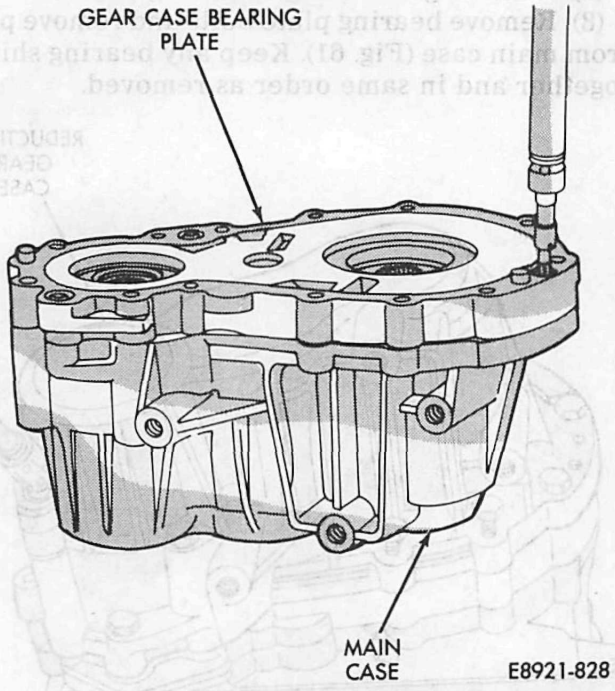


Fig. 61—Removing Gear Case Bearing Plate

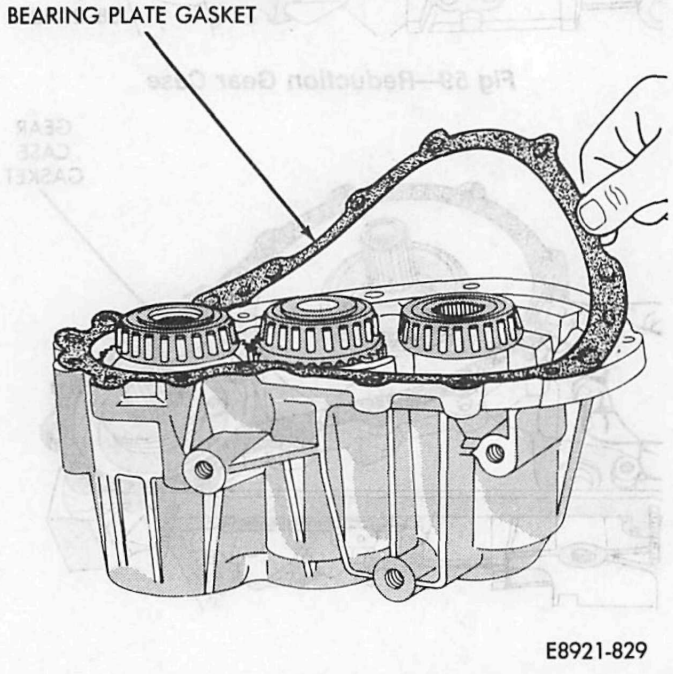


Fig. 62—Bearing Plate Gasket

Governor Removal and Disassembly

(1) Remove spring washers (Fig. 64). Note position of the four washers for assembly reference. Keep washers in same position as removed.
(2) Remove governor cover (Fig. 65).
(3) Remove governor (Fig. 66).
(4) Remove bolts attaching valves to governor and remove valves (Fig. 67).
(5) Remove the one metal and two rubber seal rings from governor body.

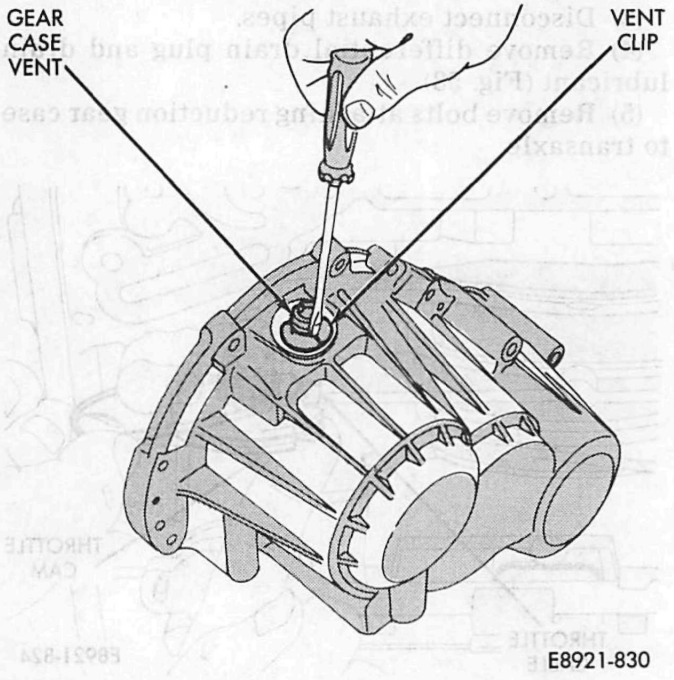


Fig. 63—Gear Case Vent

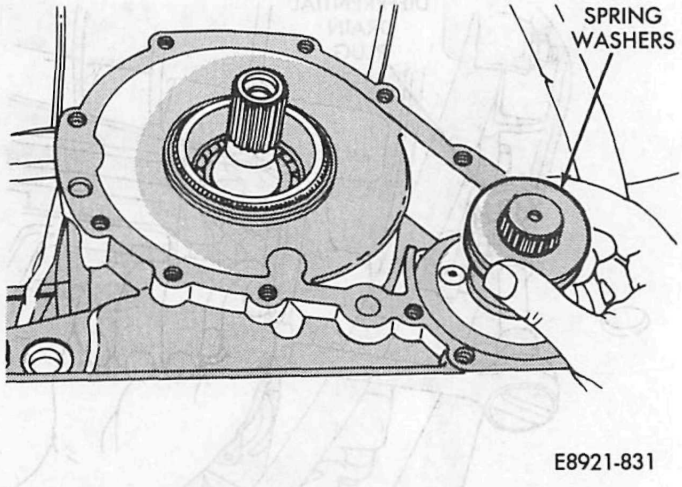


Fig. 64—Removing Governor Spring Washers

Governor Support Removal and Disassembly

(1) Remove support retainer bolt and spacer (Fig. 68).

(2) Remove governor support from case with tool 6149 (Fig. 69).

(3) Note position of two oil seats at forward end of support for assembly reference.

(4) Remove seal rings and oil seals from support.

Governor Support Assembly and Installation

(1) Install new oil seals in governor support.

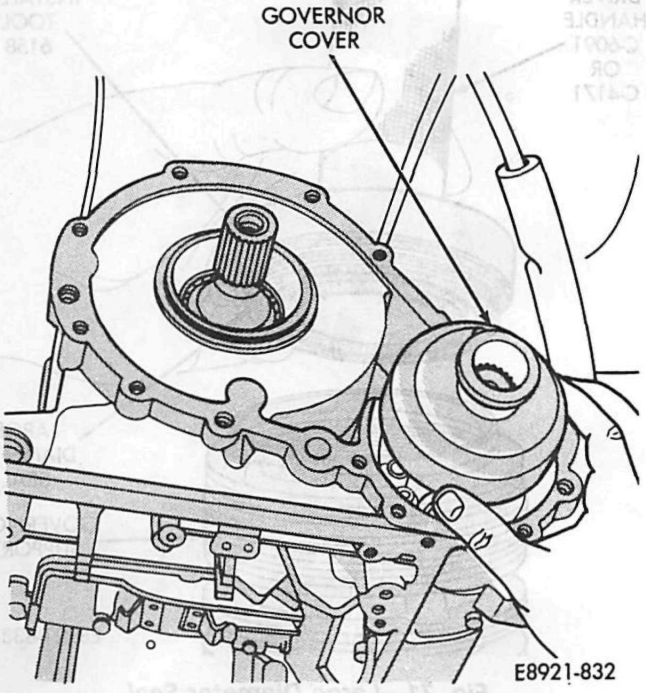


Fig. 65—Governor Cover

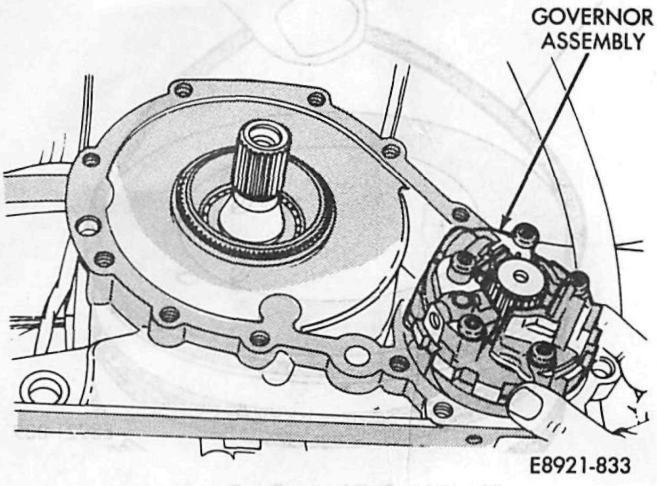


Fig. 66—Governor Assembly

CAUTION: Seal position is important. Install the small diameter seal with the seal lip toward the rear of the support. Then install the large diameter seal with the seal lip facing out.

(2) Install small diameter seal in support with tool 6157 and driver handle (Fig. 70).

(3) Install large diameter seal with tool 6158 and driver handle (Fig. 71).

(4) Install new O-rings on support (Fig. 72).

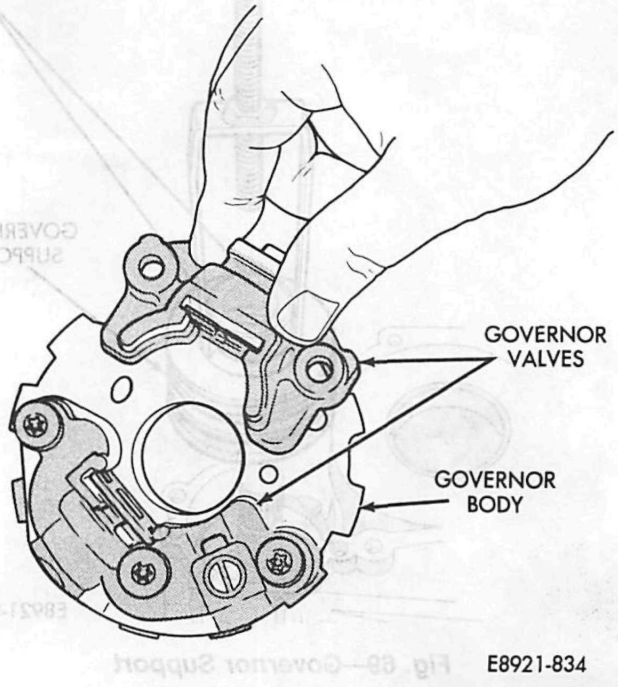


Fig. 67—Governor Valves

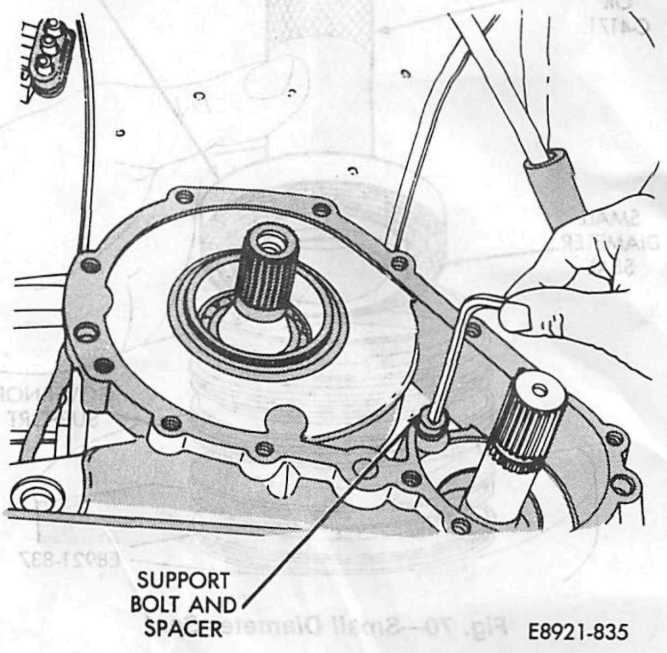


Fig. 68—Governor Support Retainer Bolt And Spacer

(5) Lubricate support seals and O-rings with petroleum jelly.

(6) Install governor support in case with turn and push motion (Fig. 73). Use plastic mallet to tap support into case if necessary.

(7) Install support retainer bolt and spacer (Fig. 74). Tighten bolt to 23 N·m (17 ft-lbs) torque.

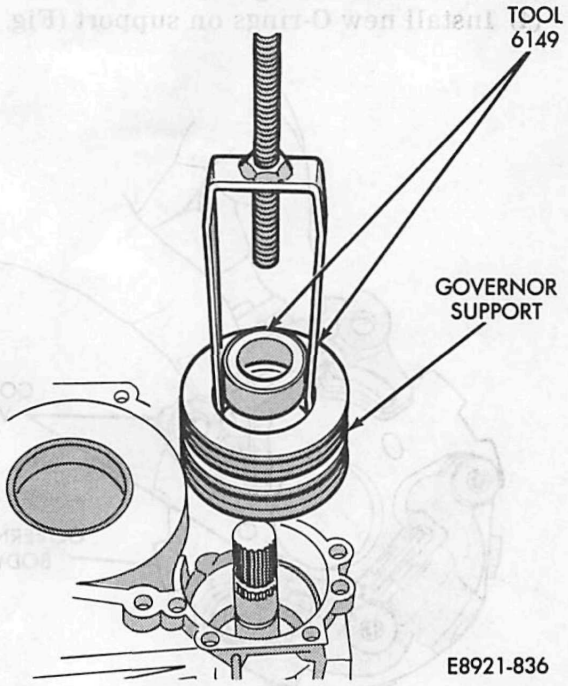


Fig. 69—Governor Support

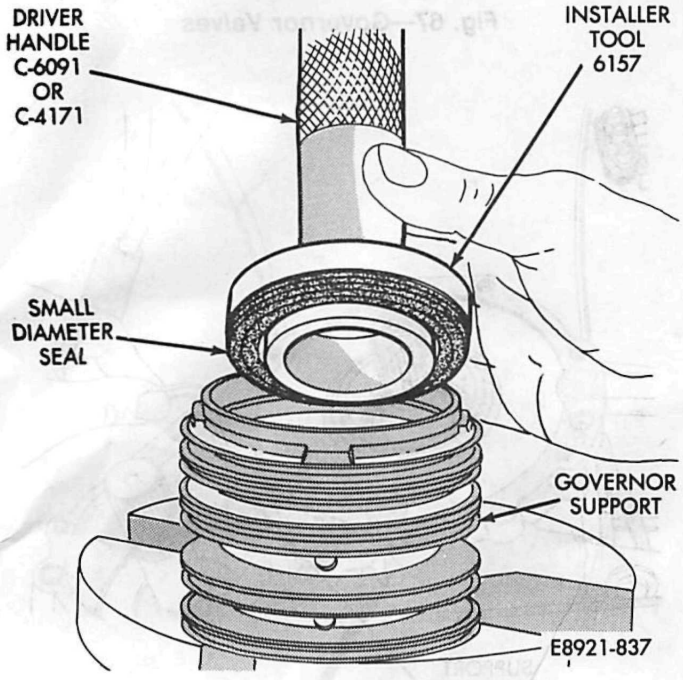


Fig. 70—Small Diameter Seal

Governor Assembly and Installation

(1) Install governor valves on governor body (Fig. 75). Tighten valve attaching bolts to 10 N·m (8 ft-lbs) torque.

(2) Install two new rubber seal rings and a new metal piston ring on governor body (Fig. 76).

(3) Install governor assembly in case (Fig. 77).

(4) Install governor cover (Fig. 78).

(5) Assembly and install the four spring washers on the governor cover (Fig. 79).

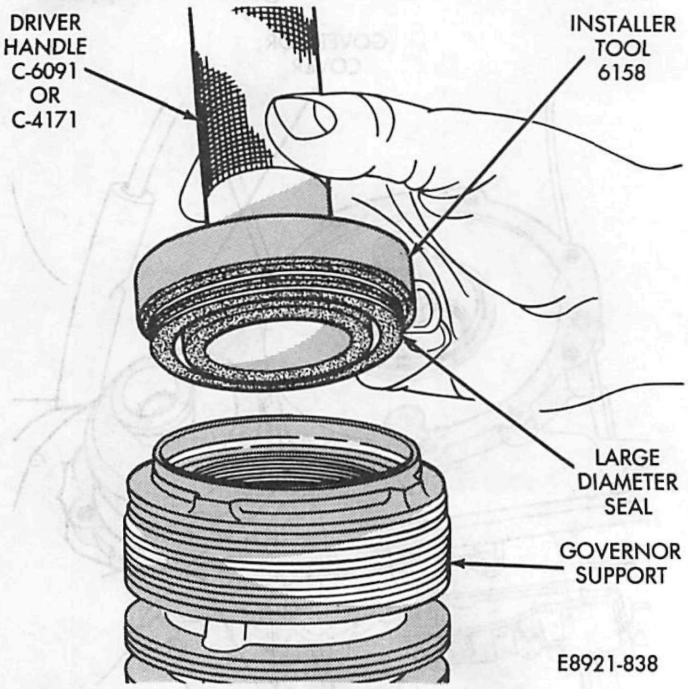


Fig. 71—Large Diameter Seal

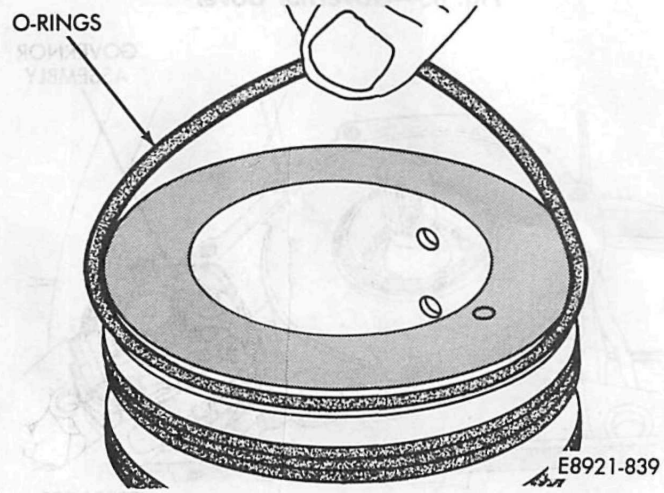


Fig. 72—O-Rings On Support

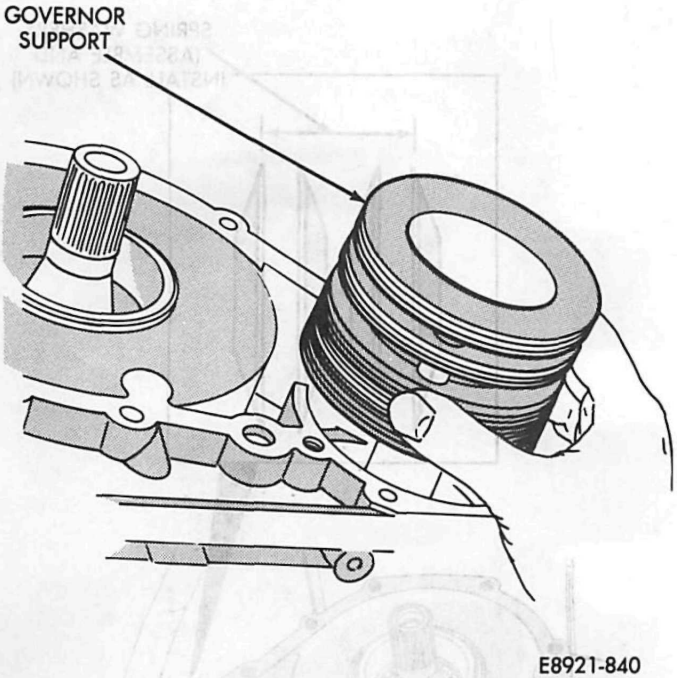


Fig. 73—Governor Support

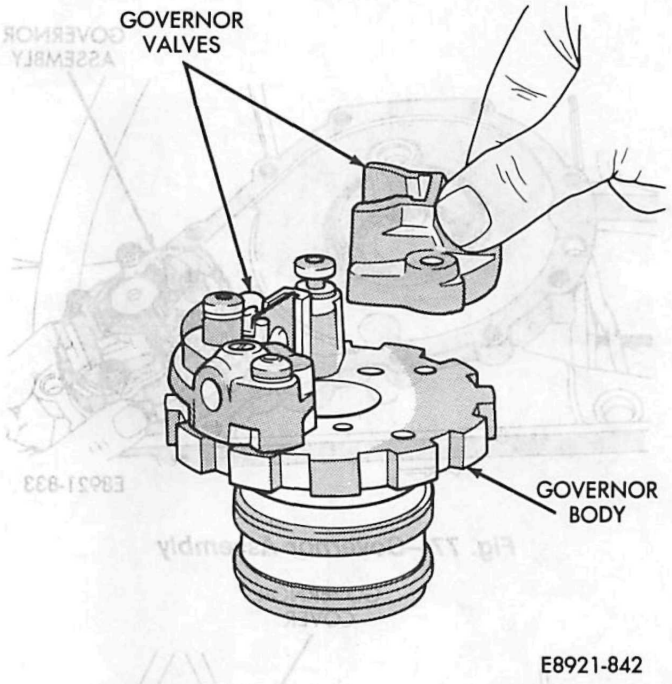


Fig. 75—Governor Valves

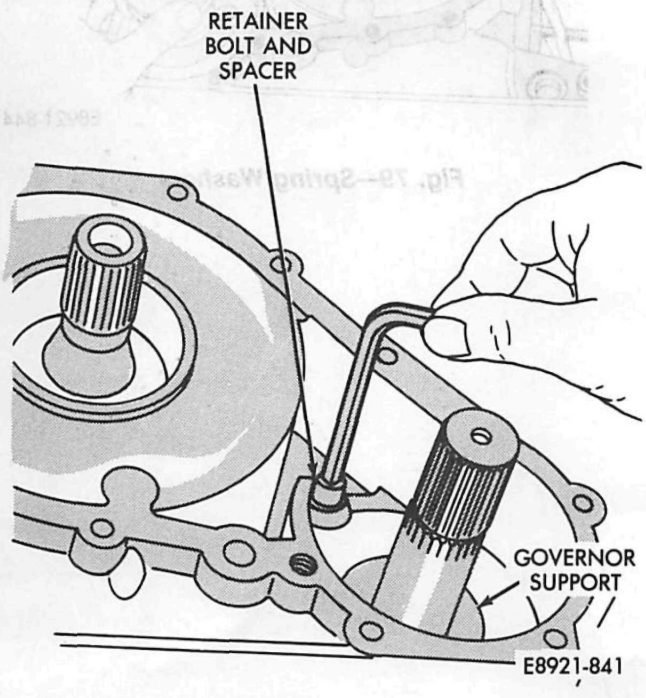


Fig. 74—Support Retainer Bolt and Spacer

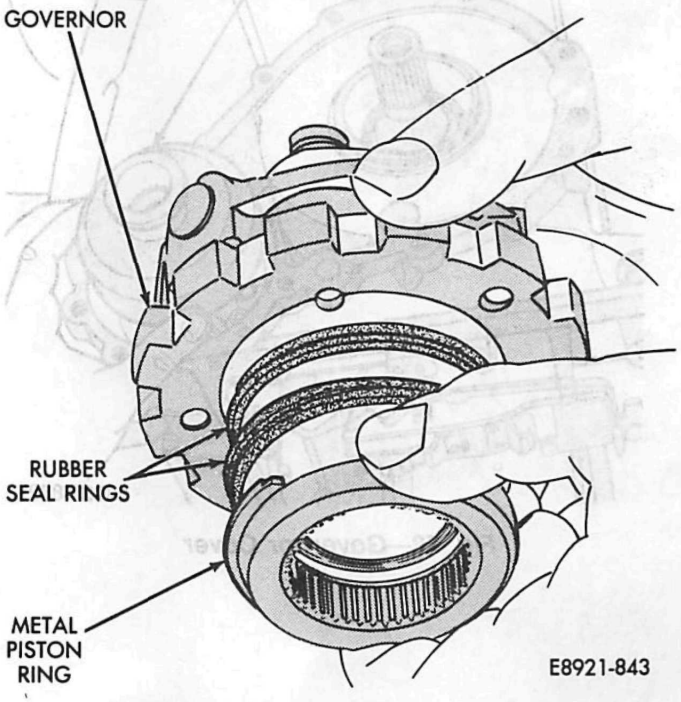


Fig. 76—Governor Piston And Seal Rings

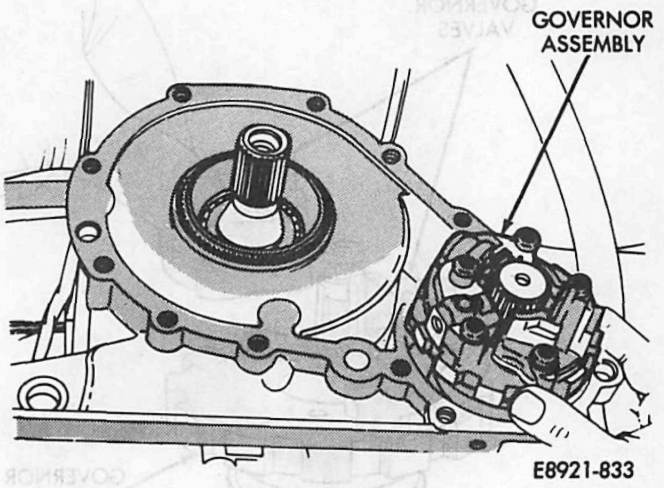


Fig. 77—Governor Assembly

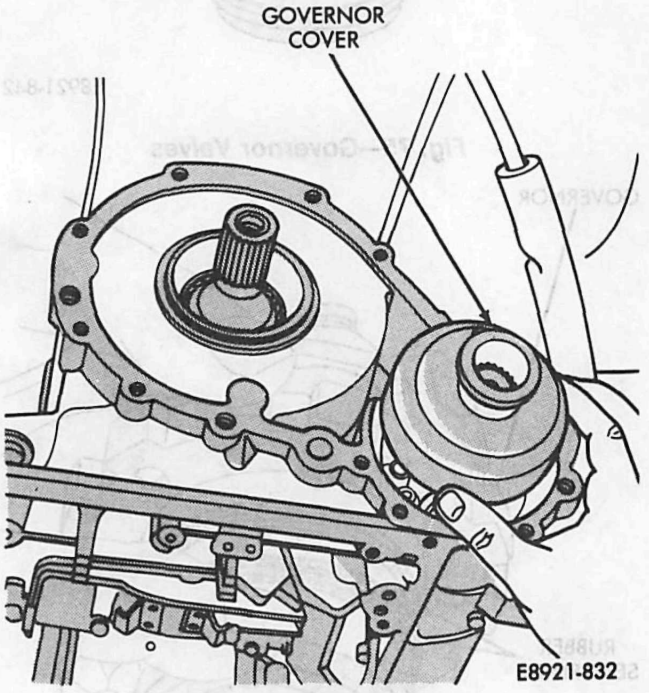


Fig. 78—Governor Cover

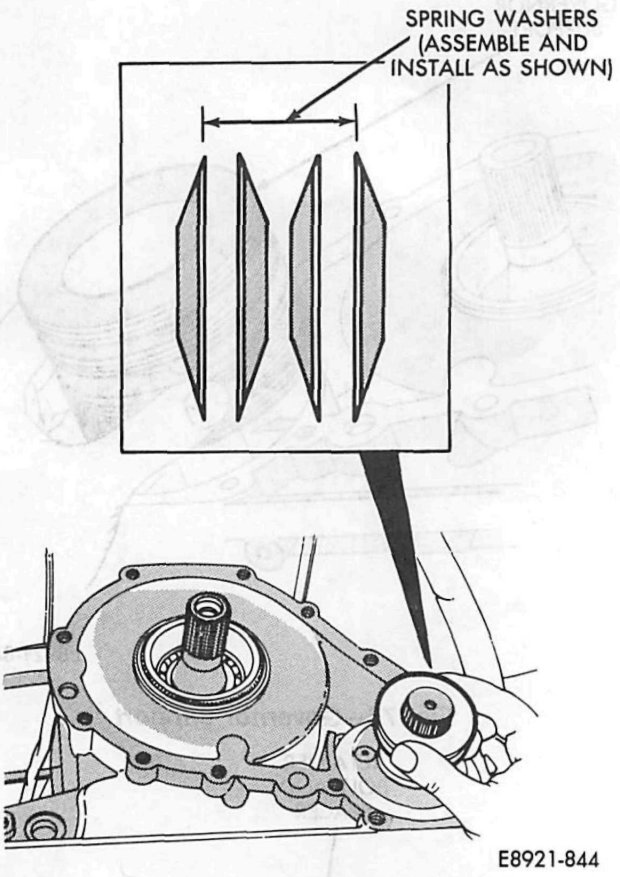


Fig. 79—Spring Washers

Reduction Gear Case Assembly and Installation

(1) Install new O-ring on case vent (Fig. 80).

(2) Install vent in gear case. Secure vent with retainer clip (Fig. 81).

(3) Install cap on gear case vent (Fig. 82).

(4) Coat new bearing plate gasket with petroleum jelly and position gasket on case (Fig. 83). Do not use any sealer on gasket. Use petroleum jelly only.

(5) Install bearing plate on case (Fig. 84). Tighten plate-to-case bolts to 8 N·m (17 ft-lbs) torque.

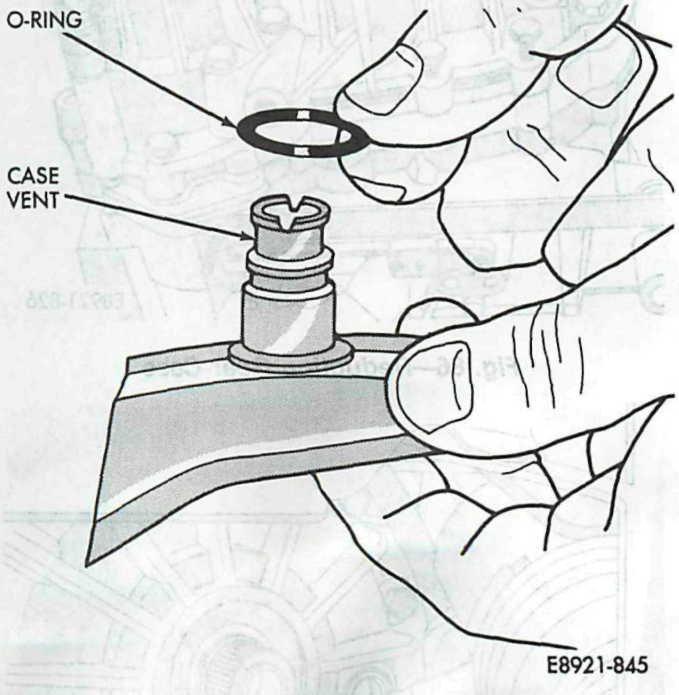


Fig. 80—O-Ring On Vent

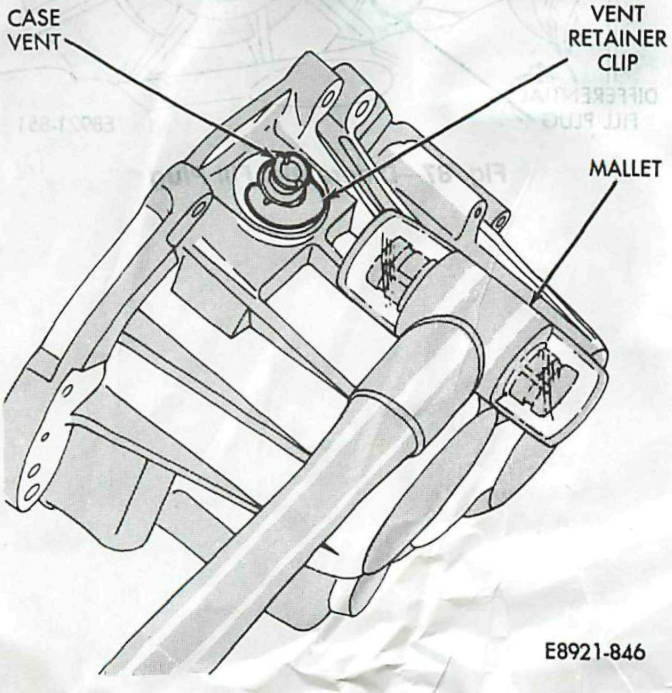


Fig. 81—Gear Case Vent

(6) Lubricate new gear case gasket with petroleum jelly and position it on transaxle (Fig. 85). Do not use any sealer on the case gasket. Use petroleum jelly only.

(7) Install reduction gear case (Fig. 86). Tighten case bolts to 23 N·m (17 ft-lbs) torque.

(8) Install and tighten differential drain plug.

(9) Remove differential fill plug (Fig. 87).

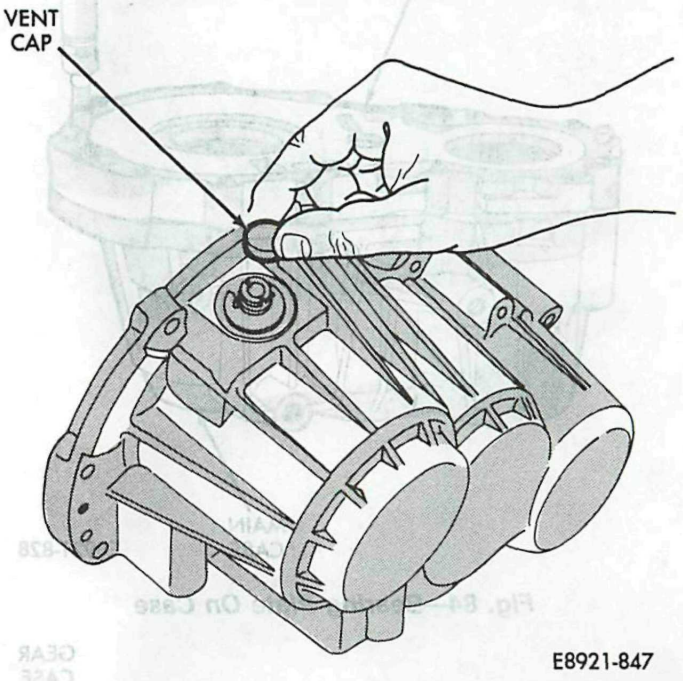


Fig. 82—Vent Cap

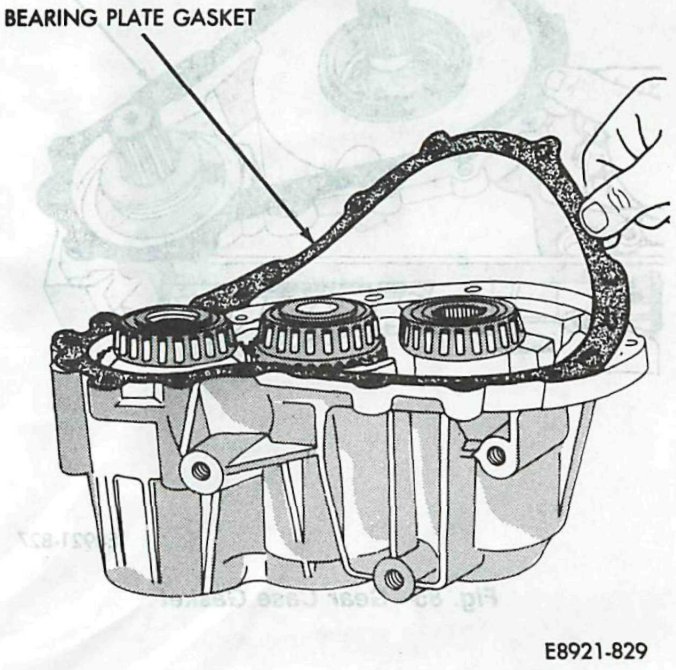


Fig. 83—Bearing Plate Gasket

(10) Fill differential with synthetic-type, 75W-140 hypoid gear lubricant. Add lubricant until it begins to flow out of fill plug hole.

(11) Install and tighten differential fill plug.

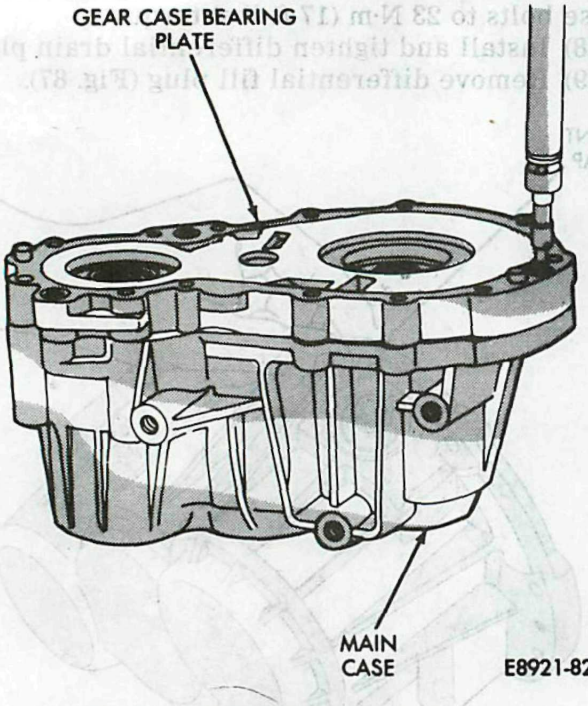


Fig. 84—Bearing Plate On Case

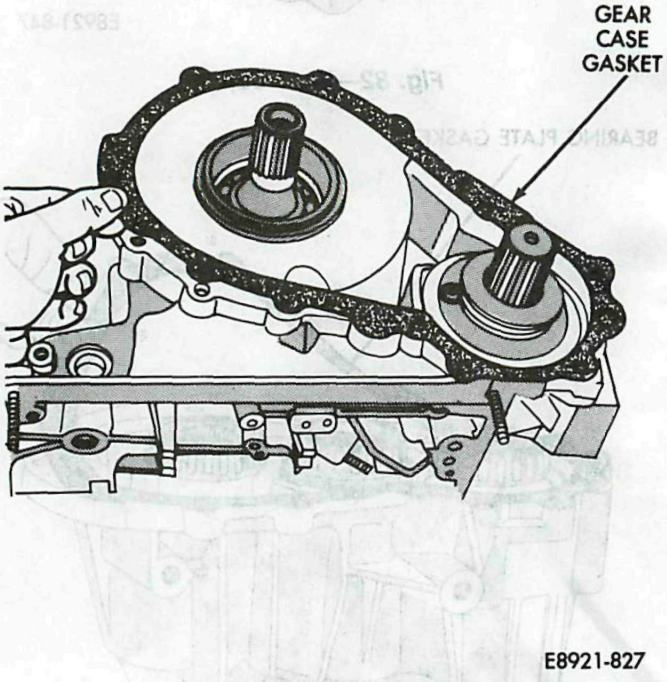


Fig. 85—Gear Case Gasket

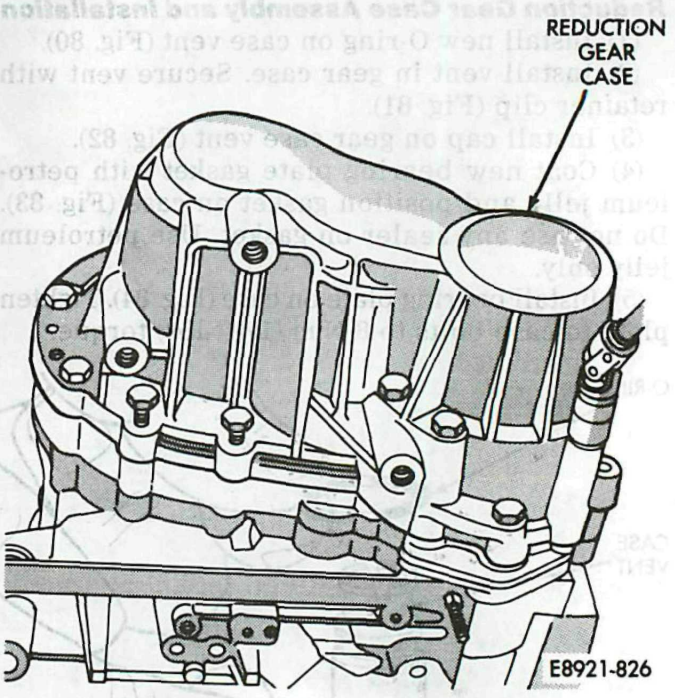


Fig. 86—Reduction Gear Case

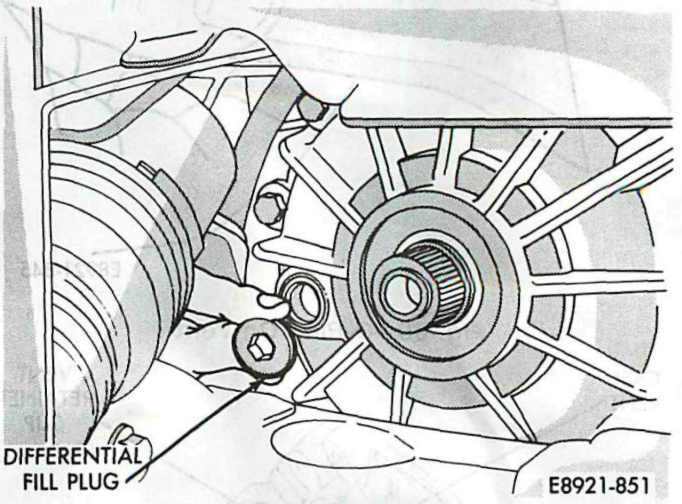


Fig. 87—Differential Fill Plug

DIFFERENTIAL OUTPUT SHAFT SEAL AND BEARING SERVICE

Short Output Shaft Removal

(1) Raise vehicle.

(2) Remove speedometer sensor.

(3) Remove differential drain plug and drain lubricant (Fig. 58).

(4) Remove roll pins attaching driveshafts to transaxle output shafts with pin punch.

(5) Remove differential fill plug (Fig. 87).

(6) Remove shaft dust cover with pry tool. (Fig. 88).

(7) Loosen shaft bolt and pull short shaft and bearing out of differential cover (Fig. 89).

(8) Pry shaft outer seal from differential cover (Fig. 90).

Differential Cover and Ring Gear Removal

(1) Remove differential cover bolts but do not remove cover at this time (Fig. 91).

(2) Raise transaxle as far as possible with jack (Fig. 92).

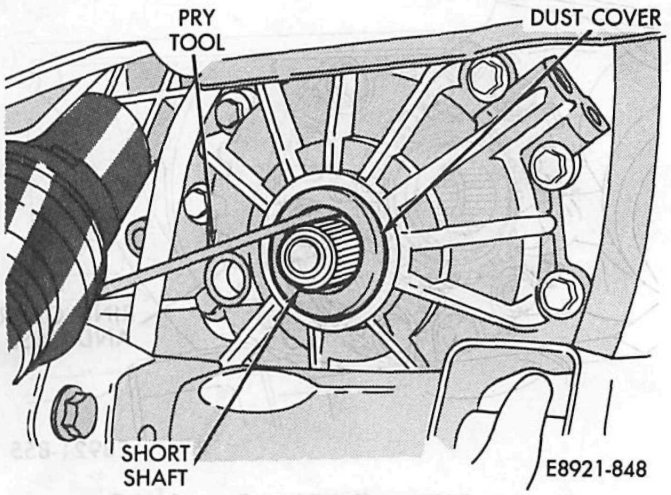


Fig. 88—Shaft Dust Cover

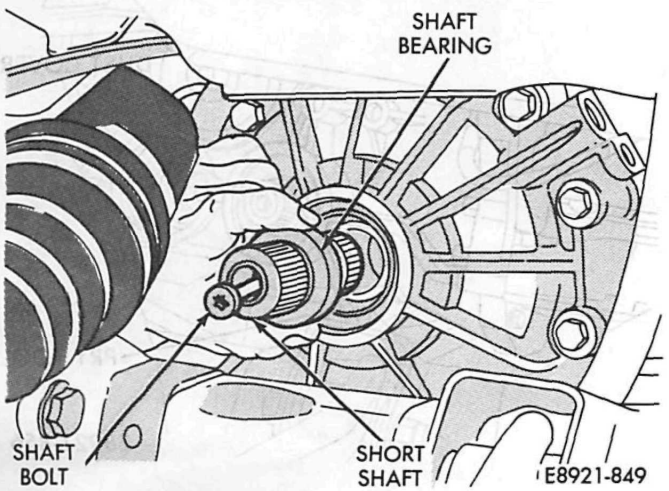


Fig. 89—Short Shaft And Bearing

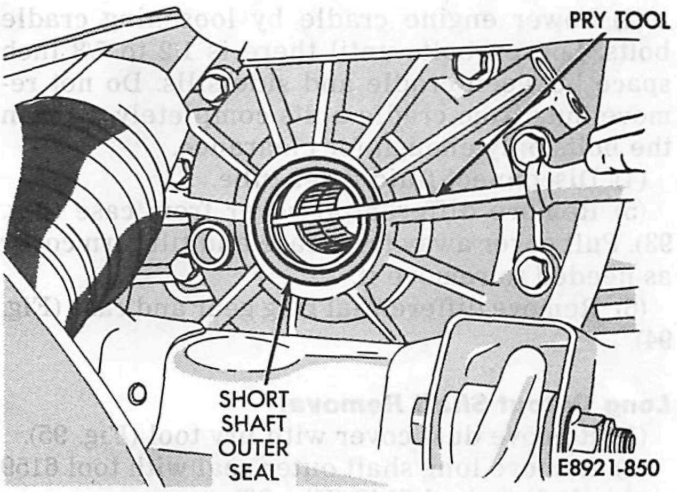


Fig. 90—Short Shaft Outer Seal

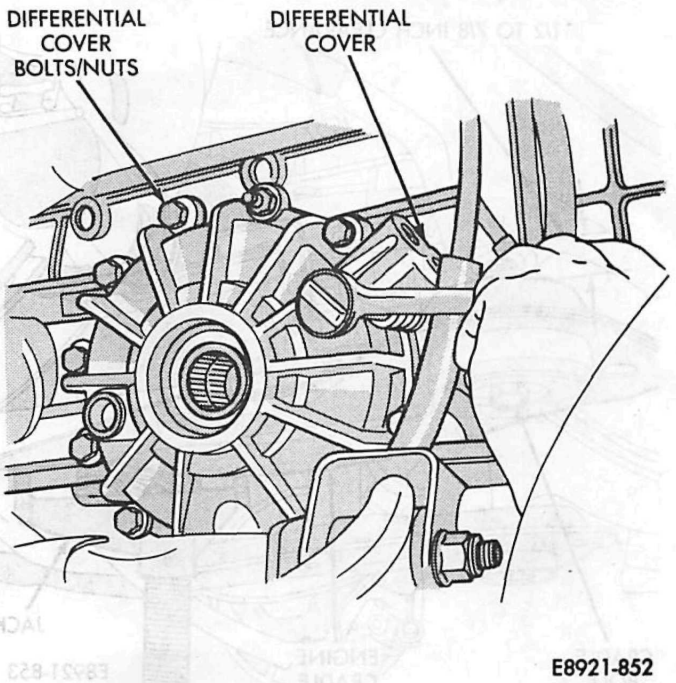


Fig. 91—Differential Cover Bolts

(3) Lower engine cradle by loosening cradle bolts. Loosen bolts until there is 1/2 to 7/8 inch space between cradle and side sills. Do not remove nuts from cradle bolts completely. Loosen the bolts only enough for clearance.

(4) Disconnect fluid filler tube.

(5) Remove differential cover from case (Fig. 93). Pull cover away from case and tilt/turn cover as needed to remove it.

(6) Remove differential ring gear and case (Fig. 94).

Long Output Shaft Removal

(1) Remove dust cover with pry tool (Fig. 95).

(2) Remove long shaft outer seal with tool 6159 and bolt from tool 6149 (Fig. 96).

(3) Remove long shaft snap ring (Fig. 97).

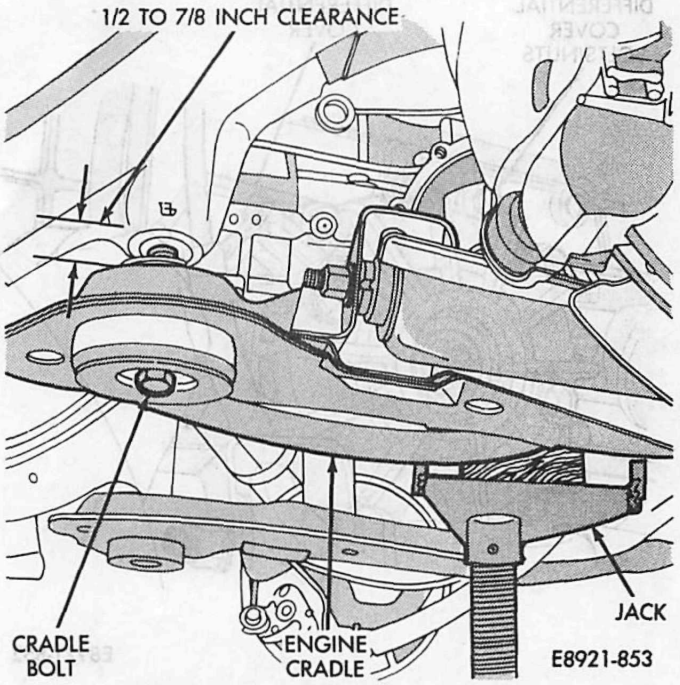


Fig. 92—Lowering Engine Cradle

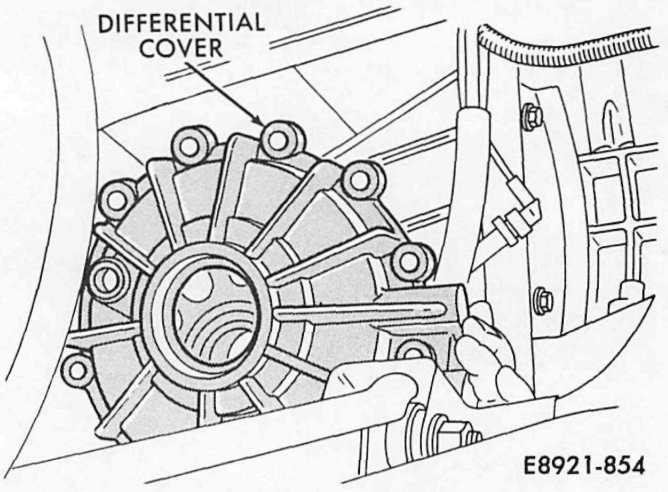


Fig. 93—Differential Cover

(4) Remove long shaft and bearing from case (Fig. 98).

(5) Remove long and short shaft inner seals with pry tool (Fig. 99).

CAUTION: Do not damage the seal bores with the pry tool during seal removal.

Output Shaft Seal and Bearing Replacement

(1) Remove snap ring that retains bearing on long shaft (Fig. 100).

(2) Press long shaft out of bearing with shop press (Fig. 101).

(3) Press new bearing on long shaft with tool 6153 and shop press (Fig. 102).

(4) Install bearing snap ring. Be sure snap ring is seated in groove.

(5) Pack both sides of long shaft bearing with grease.

(6) Install new O-ring in groove of long shaft (Fig. 103).

(7) Install new O-ring in groove of short shaft (Fig. 104).

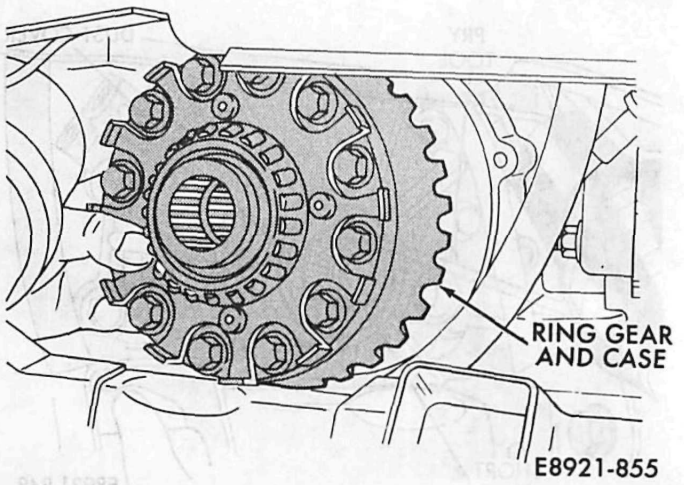


Fig. 94—Differential Ring Gear And Case

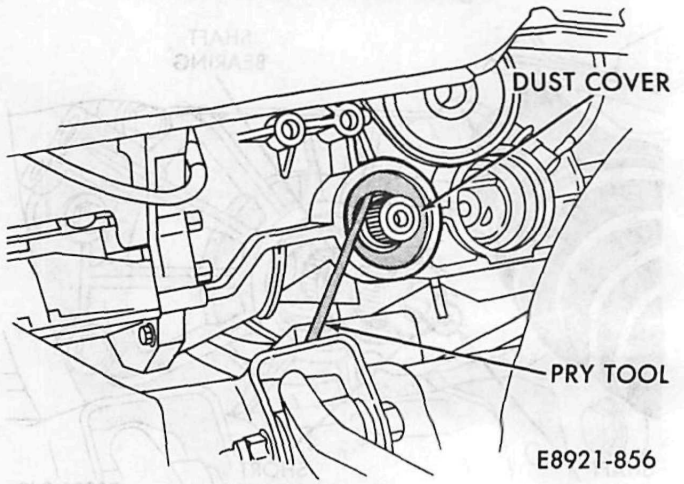


Fig. 95—Removing Dust Cover

(8) Install short shaft inner seal with tool 6174 and driver handle (Fig. 105).

(9) Install long shaft inner seal with tool 6154 and driver handle.

Output Shaft/Differential/Differential Cover Installation

(1) Install long shaft in case and secure shaft with new snap ring (Fig. 97). Be sure shaft bearing is packed full of grease before installing shaft.

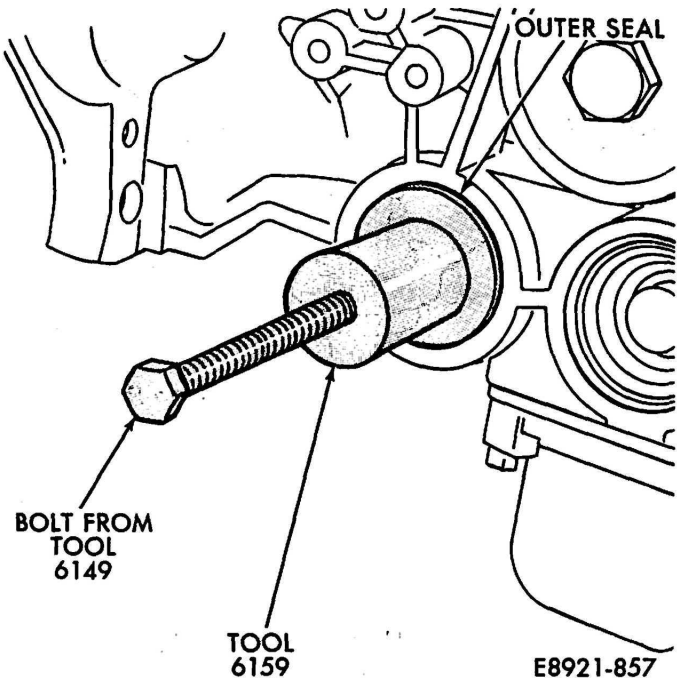


Fig. 96—Long Shaft Outer Seal

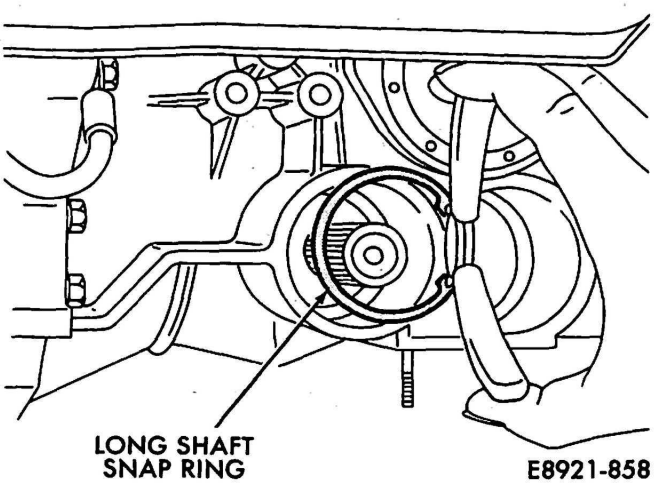


Fig. 97—Long Shaft Snap Ring

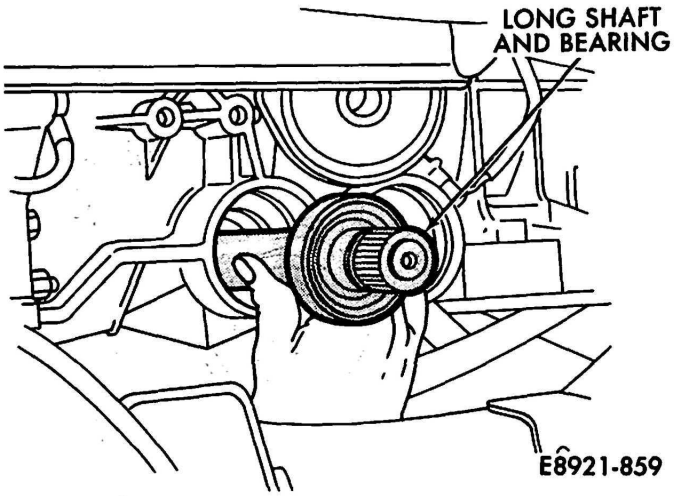


Fig. 98—Long Shaft And Bearing

(2) Install long shaft outer seal with two-piece tool 6152 (Fig. 107). Inner part of tool acts as seal guide. Outer part of tool serves as a slide hammer to tap seal into place.

(3) Install dust cover over long shaft outer seal with tool 6156 and driver handle (Fig. 108).

(4) Install differential ring gear and case (Fig. 94).

(5) Install new seal on differential cover (Fig. 109).

(6) Install differential cover on case. Tighten cover bolts to 23 N·m (17 ft-lbs) torque.

(7) Tighten engine cradle nuts and remove jack used to raise and support transaxle.

(8) Install short output shaft (Fig. 110). Tighten shaft bolt to 25 N·m (18 ft-lbs) torque.

(9) Install short shaft outer seal with two-piece tool 6152. Inner part of tool acts as seal guide. Outer part acts as a slide hammer to tap seal into place (Fig. 107).

(10) Install dust cover over short shaft outer seal with tool 6156 and driver handle (Fig. 108).

(11) Install differential drain plug if not previously installed.

(12) Fill differential with synthetic-type, 75W-140, hypoid gear lubricant. Add lubricant until it starts to flow out hole then install fill plug.

(13) Attach driveshafts to differential output shafts. Use a pin punch to install driveshaft roll pins.

(14) Install speedometer sensor.

(15) Install splash shield and any exhaust components that were removed or loosened.

(16) Lower the vehicle.

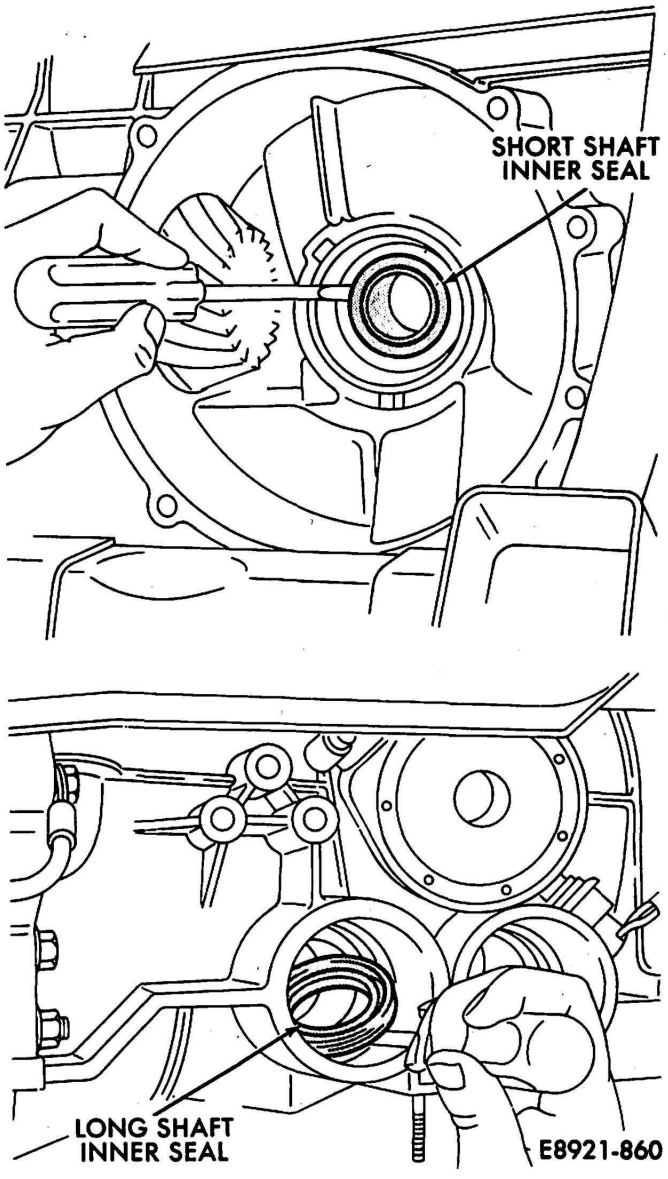


Fig. 99—Shaft Inner Seals

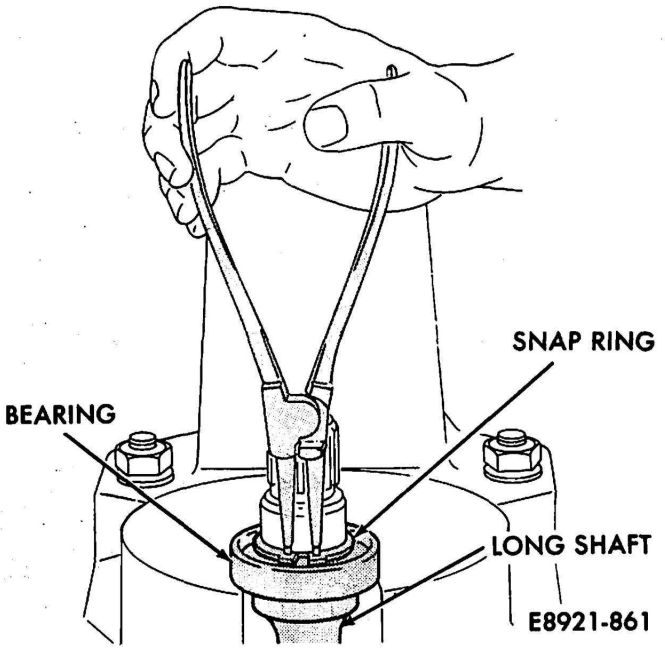


Fig. 100—Long Shaft Bearing Snap Ring

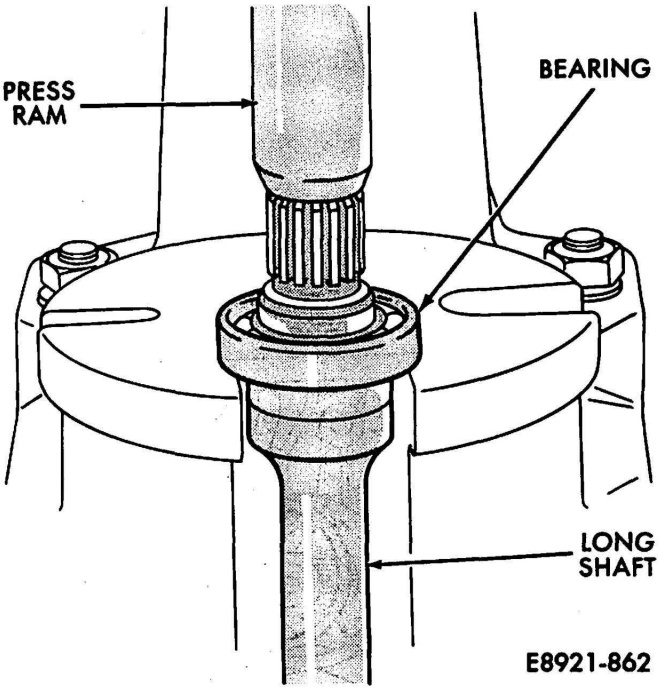


Fig. 101—Long Shaft Bearing

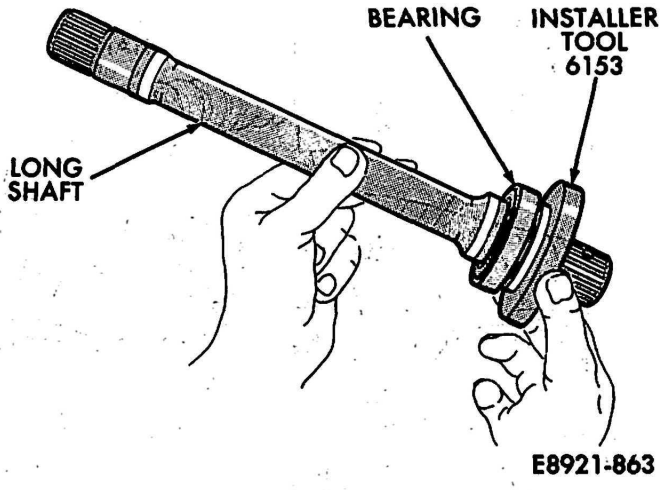


Fig. 102—Long Shaft Bearing

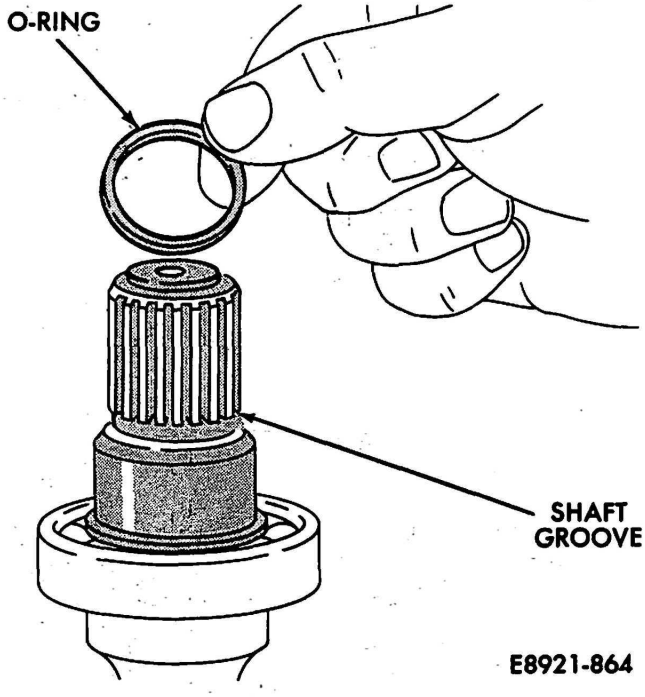


Fig. 103—Long Shaft O-Ring

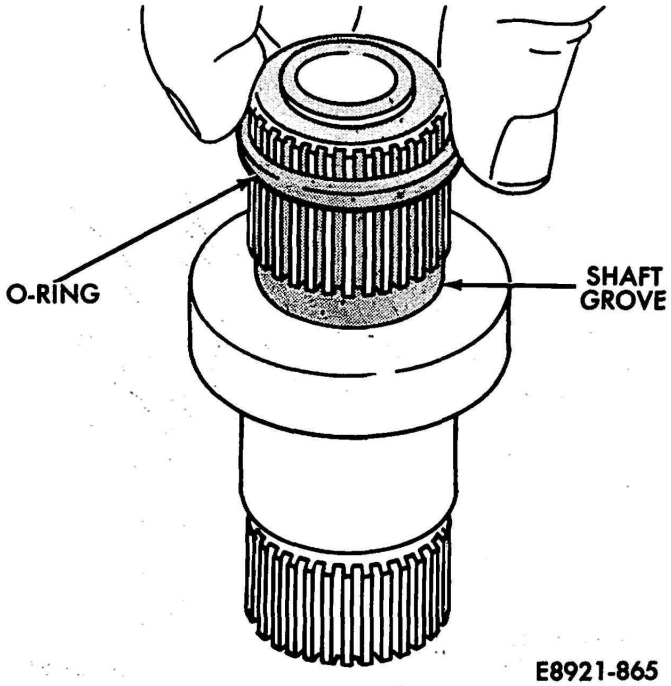


Fig. 104—Short Shaft O-Ring

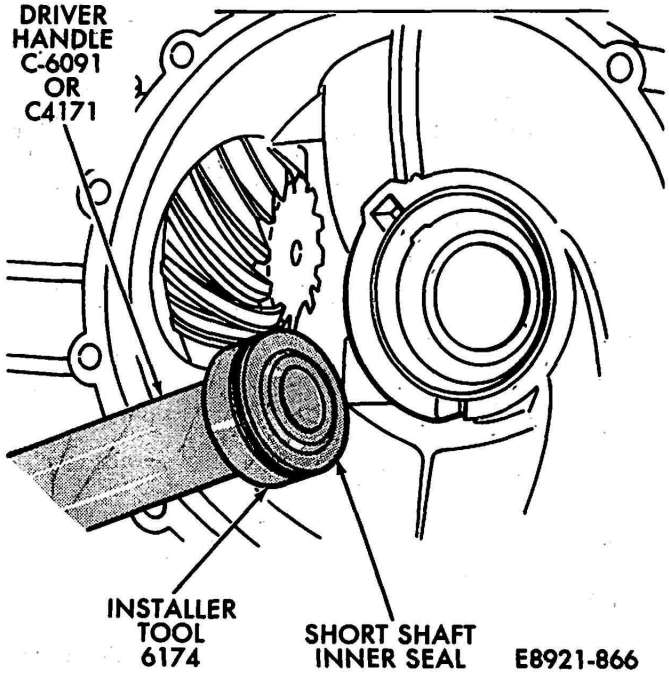


Fig. 105—Short Shaft Inner Seal

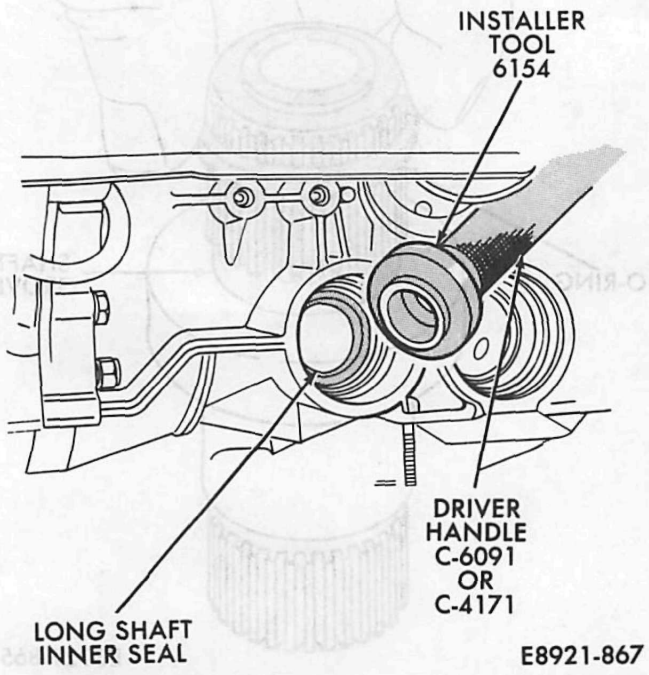


Fig. 106—Long Shaft Inner Seal

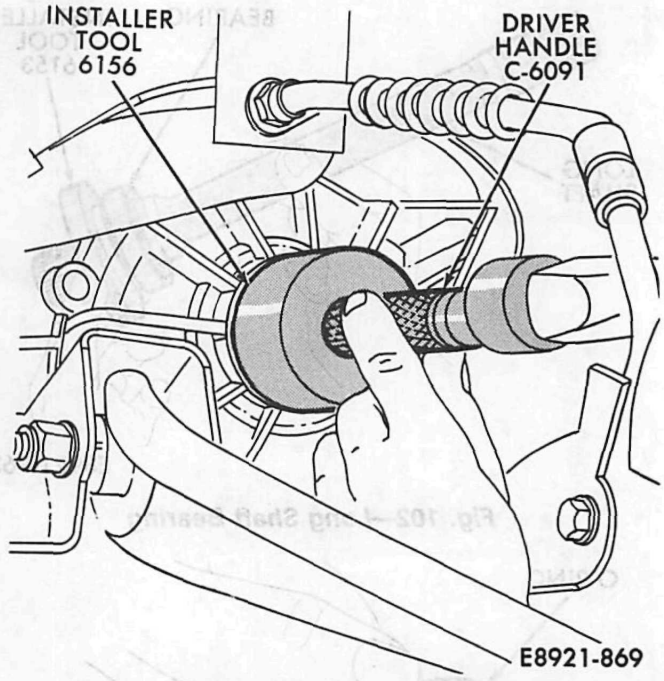


Fig. 108—Long Shaft Dust Cover

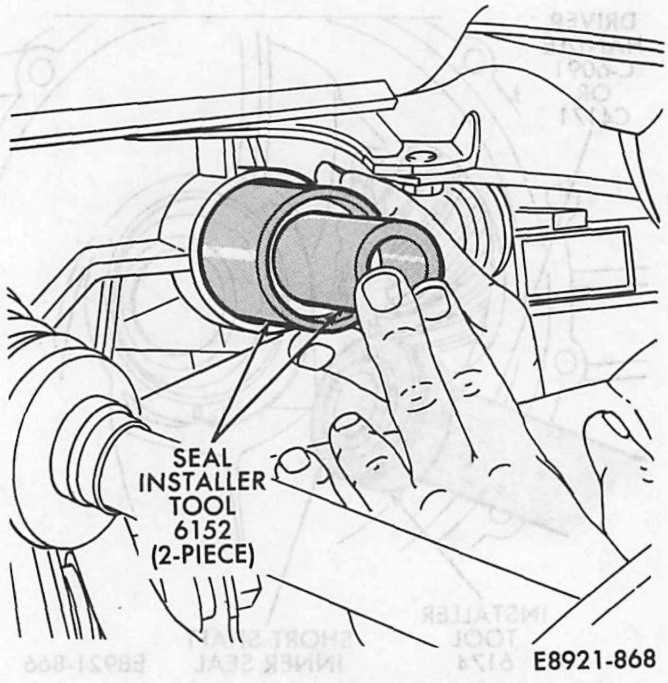


Fig. 107—Long Shaft Outer Seal

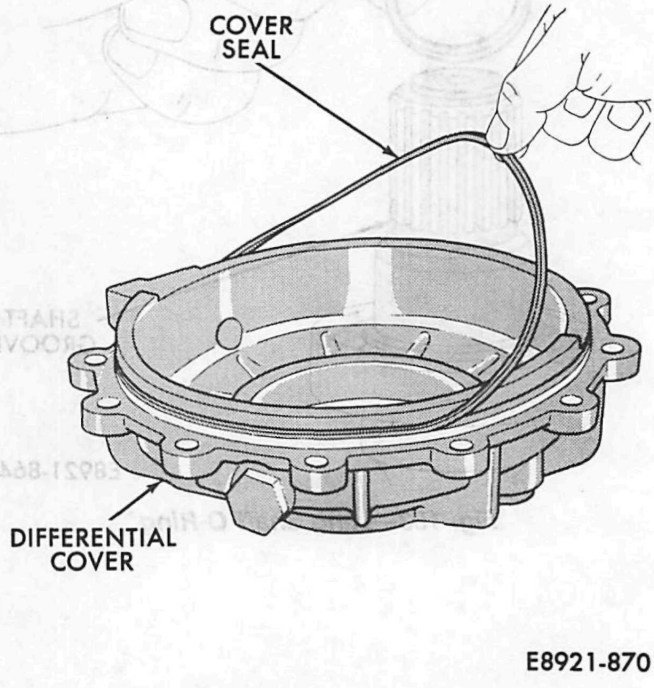


Fig. 109—Differential Cover Seal

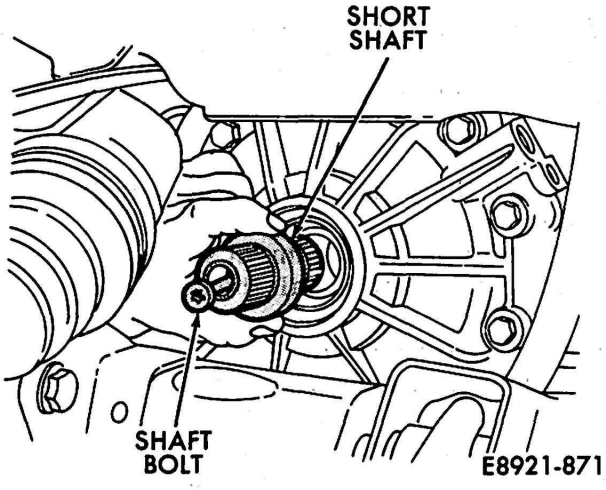


Fig. 110—Short Shaft And Bolt

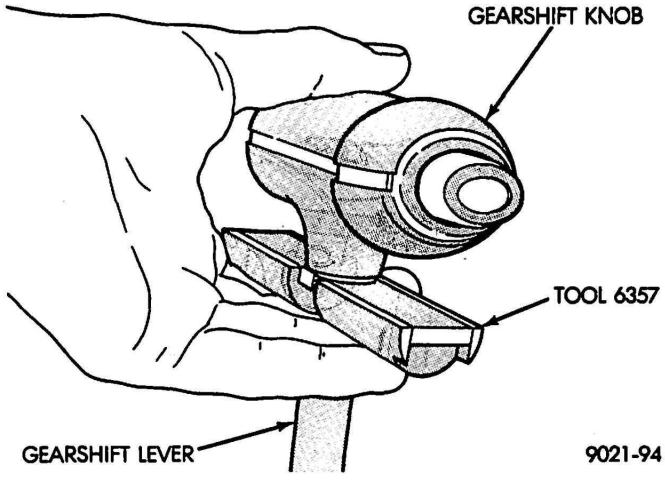


Fig. 111—Remove Gearshift Knob

SHIFT CABLE REPLACEMENT

(1) Remove instrument panel lower trim cover.
(2) Remove gearshift knob (Fig. 111).
(3) Disconnect gearshift cable from gearshift mechanism (Fig. 112).
(4) Raise vehicle.
(5) Disconnect cable at transmission shift lever. Pry cable end upward to remove it.
(6) Unseat cable grommet from floor pan. Then pull cable out through grommet hole.
(7) Remove clamps and tie straps securing cable and remove cable from vehicle.
(8) Insert new cable into driver compartment through grommet hole in floor pan. Seat cable grommet in floorpan.
(9) Route cable around and over transaxle to shift lever.
(10) Install cable retaining clips.
(11) Install cable in transaxle bracket and attach cable to transaxle shift lever. If the transaxle shift lever was removed for any reason, use a new retaining nut to secure the lever on the manual shaft. The retaining nut has a plastic thread insert and is not reusable.
(12) Lower the vehicle.
(13) Install cable in dash bracket.
(14) Connect gearshift cable to gearshift mechanism (Fig. 112).
(15) Press the cross-lock downward into the locked position. (Fig. 114).

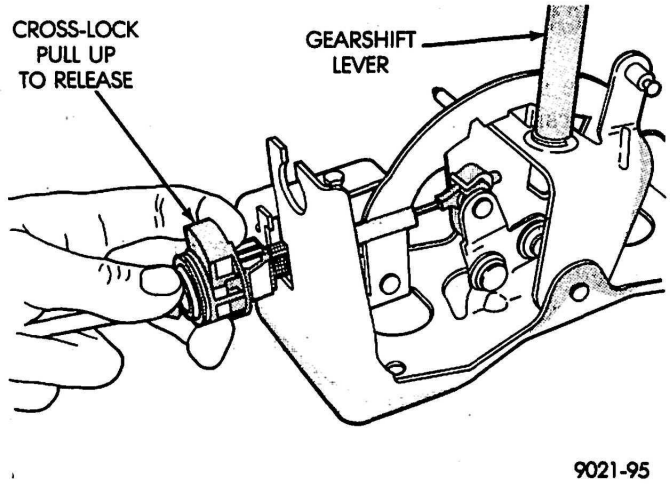


Fig. 112—Gearshift Cable

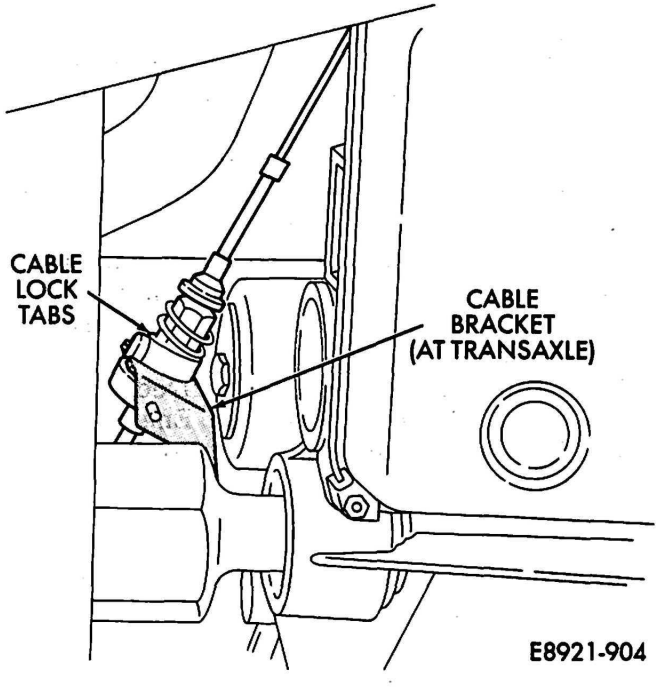


Fig. 113—Shift Cable At Transaxle Bracket

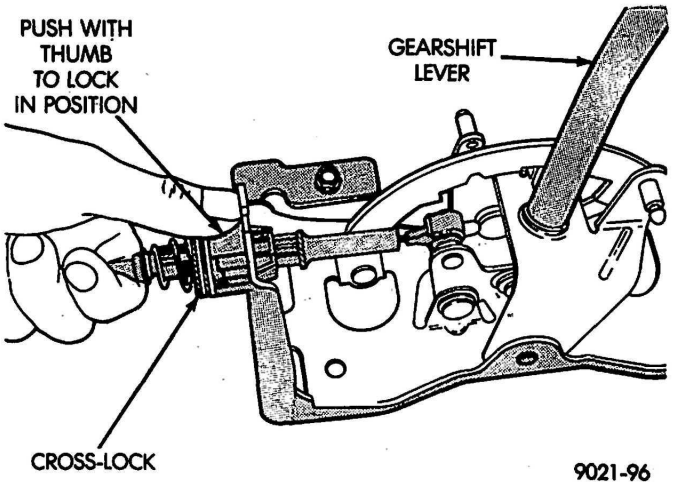


Fig. 114—Gearshift Cable Attachment

SHIFT CABLE ADJUSTMENT

(1) Be sure the cable is securely connected to the gearshift mechanism before proceeding.
(2) Shift shift lever into Park.
(3) Release the shift cable cross-lock by pulling it upward (Fig. 112).
(4) Move the transaxle shift lever all the way rearward into the Park detent. Be sure the lever is centered in the detent.
(5) Verify positive engagement of the park lock by attempting to rotate the driveshafts. The shafts cannot be turned if the park lock is properly engaged.
(6) Verify that the cable is properly routed and secured and that the cable grommet is fully seated in the floorpan.
(7) Then press the cable cross-lock downward until it snaps in place (Fig. 114).
(8) Position the cable self-adjusting unit in the fork of the lower cable mounting bracket at transaxle. Use the index key to properly index and seat the cable within the bracket.
(9) Seat the cable core end fitting onto the transaxle operating lever pin.
(10) At the transaxle end fitting, push the core-adjust slider mechanism until it snaps into a locked position. This will properly adjust and lock the gearshift cable.
(11) No other adjustment is required.
(12) Check shift cable adjustment. Engine should start in Park and Neutral positions only.

TORQUE CONVERTER SERVICE

The torque converter used with ZF transaxles is not serviceable. The converter must be replaced if damaged in any way.

The transaxle assembly must be removed for access to the converter.

Remove the converter from the transmission by pulling the converter straight out of the pump and converter housing.

Oil Pump Seal

Remove the pump seal with Tool 6149 and a slide hammer.

Lubricate the replacement seal lip with transmission fluid. Then install the seal with tool 6201.

Torque Converter Drive Plate Service

The converter driveplate can be serviced after the converter has been removed.

Inspect the driveplate carefully. Replace the driveplate if warped, cracked, or otherwise damaged.

When installing the driveplate, use replacement attaching bolts. Do not reuse the old bolts at any time.

ZF TRANSAXLE REMOVAL

(1) Disconnect the battery.
(2) Loosen throttle valve cable locknuts and remove cable from engine bracket (Fig. 1).
(3) Raise vehicle.
(4) Remove front wheels.
(5) Remove steering knuckle upper bolt but only loosen lower bolt (Fig. 2). The steering knuckle bolts are splined. Do not turn bolts to loosen them. Hold each bolt head with a wrench and loosen/remove the nuts as needed. Then tap upper bolt out of strut and knuckle with mallet.
(6) Tilt steering knuckle outward (Fig. 3).
(7) Remove splash shield (Fig. 4).
(8) Position drain pan under transmission oil pan.
(9) Loosen nut attaching transmission fill tube to oil pan and drain transmission fluid.
(10) Tighten fill tube attaching nut to 74 N· (74 ft-lbs) torque after draining fluid.
(11) Remove converter housing side and bottom covers (Fig. 6).
(12) Remove bolts attaching converter to driveplate (Fig. 7).
(13) Remove roll pins attaching driveshafts to differential output shafts.
(14) Pull driveshafts off differential output shafts.
(15) Support transaxle with jack stand. Take care to avoid damaging oil pan.
(16) Remove nuts attaching crossmember to side sills (Fig. 8).
(17) Remove bolt and nut attaching rear cushion to transaxle support bracket (Fig. 9).

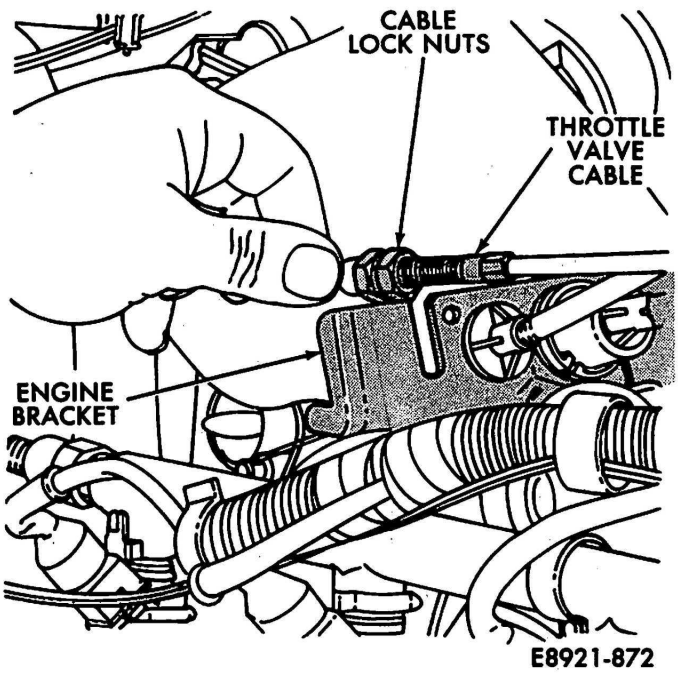


Fig. 1—Removing Throttle Valve Cable From Engine Bracket

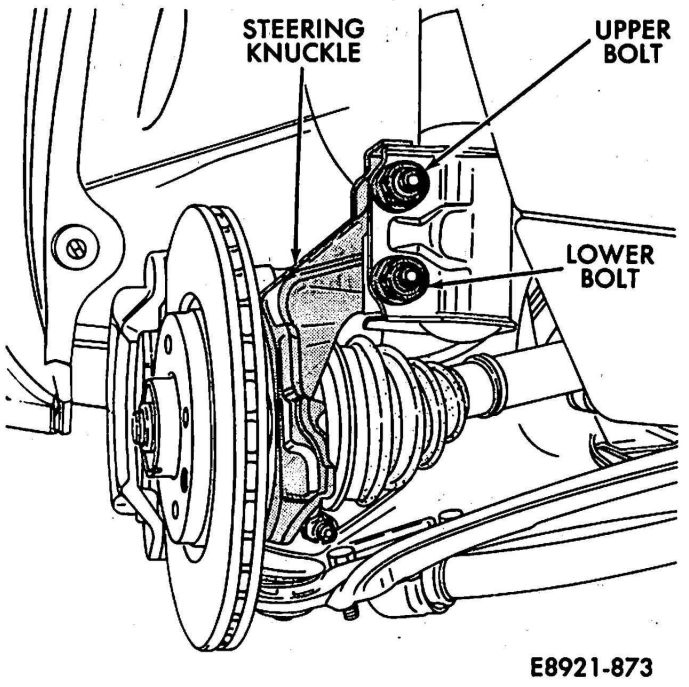


Fig. 2—Steering Knuckle Bolts

(18) Remove bolts attaching exhaust pipe bracket to rear cushion (Fig. 9).

(19) Remove crossmember and rear cushion as assembly.

(20) Remove support bracket bolts and remove bracket from transaxle (Fig. 10).

(21) Disconnect front exhaust pipes at manifolds (Fig. 11).

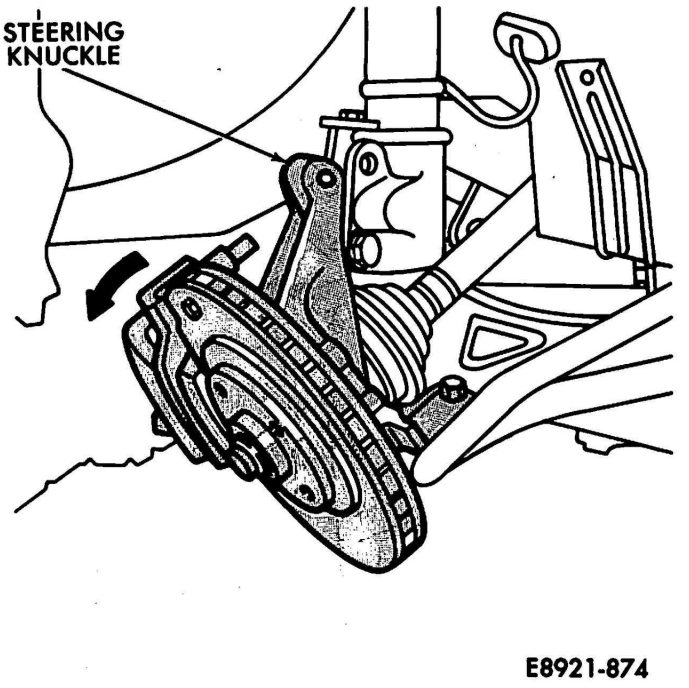


Fig. 3—Positioning Steering Knuckle

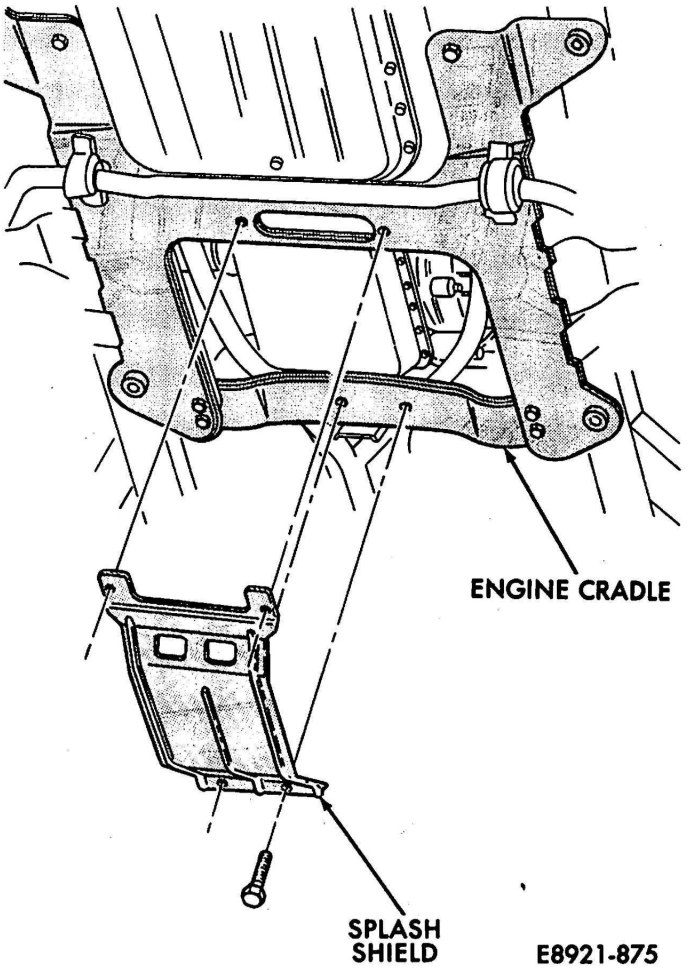


Fig. 4—Splash Shield

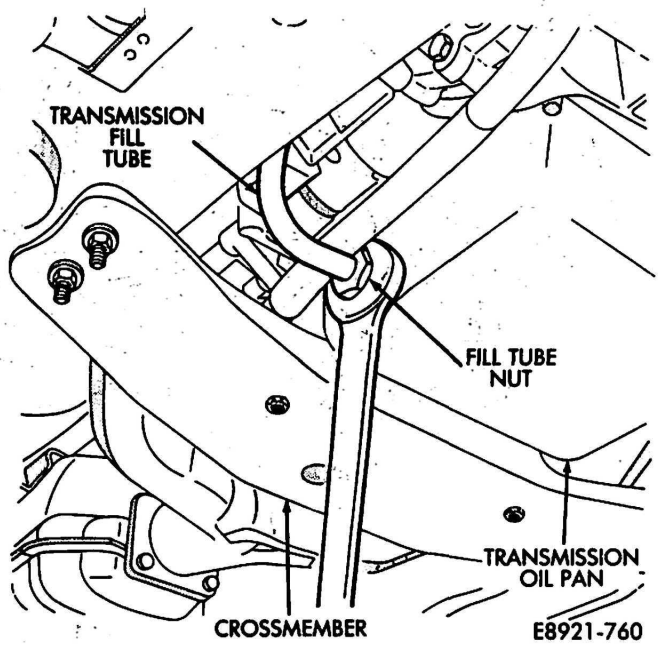


Fig. 5—Draining Transmission Fluid

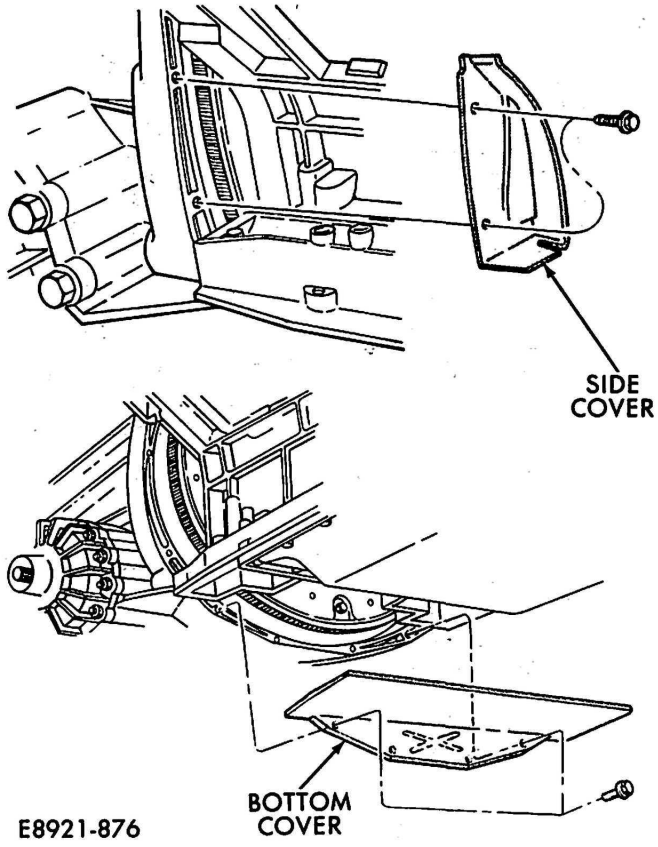


Fig. 6—Converter Housing Covers

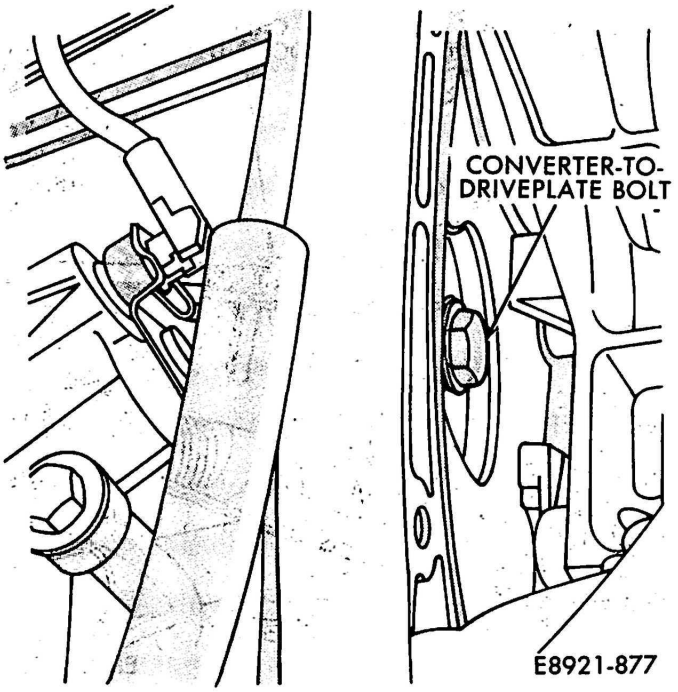


Fig. 7—Converter Driveplate Bolt Location

(22) Remove nuts attaching exhaust pipe bracket to front Y-pipe (Fig. 12).

(23) Remove nuts attaching catalytic converter to Y-pipe (Fig. 13).

(24) Disconnect oxygen sensor wires (Fig. 13).

(25) Lower engine cradle for working clearance. Loosen engine cradle bolts until there is 1/2 to 7/8 inch space between cradle and side sill (Fig. 14). Do not remove bolts completely and do not lower cradle any more than specified.

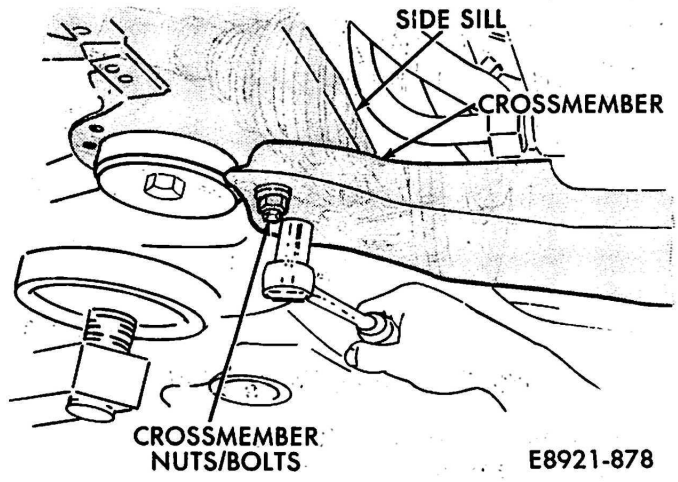


Fig. 8—Crossmember-To-Side Sill Nuts

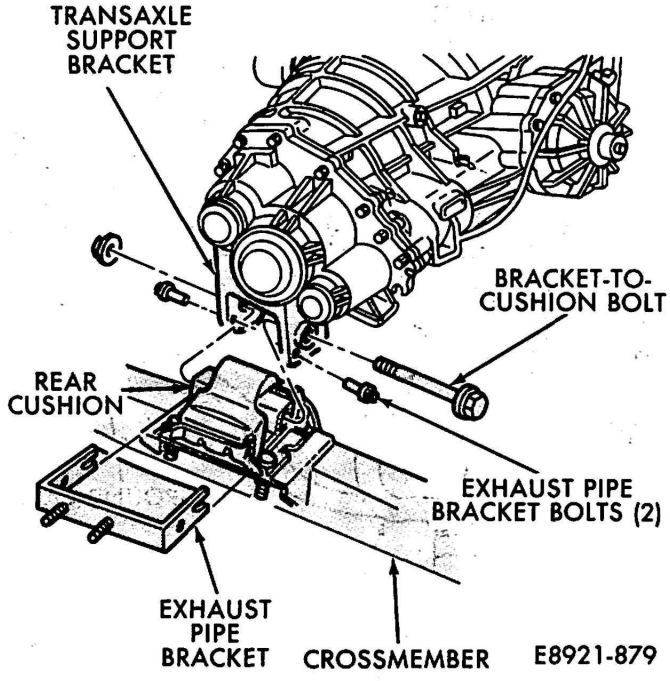


Fig. 9—Crossmember And Cushion

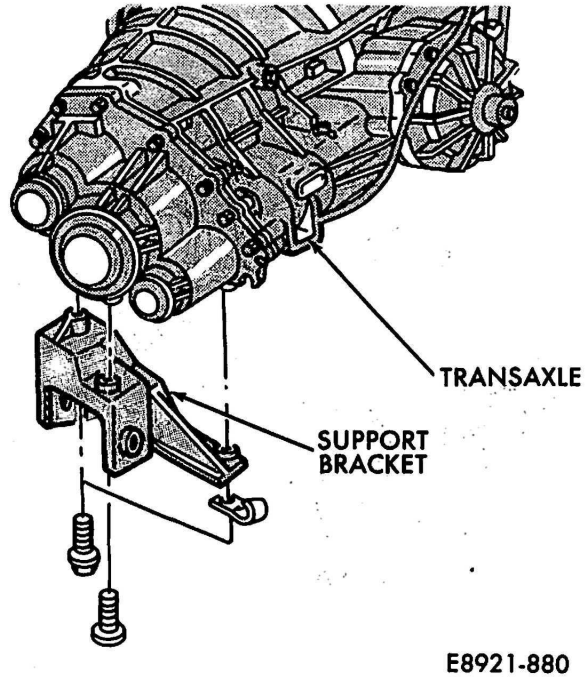


Fig. 10—Support Bracket

(26) Remove front exhaust pipe assembly.

(27) Disconnect cables and relay wire at starter (Fig. 15).

(28) Remove starter bolts and remove starter, plate and dowel. (Fig. 16).

(29) Disconnect shift cable at transmission shift lever (Fig. 17).

(30) Remove cable bracket bolts and remove bracket (Fig. 17).

(31) Remove brace rod (Fig. 18). After removing brace rod, reinstall rear bolt to hold neutral switch in place.

(32) Squeeze lock tabs on shift cable and remove cable from bracket (Fig. 19).

(33) Remove engine speed sensor (Fig. 20).

(34) Disconnect transmission fluid cooler hoses (Fig. 21). Then clamp-off, or plug hoses to prevent fluid loss.

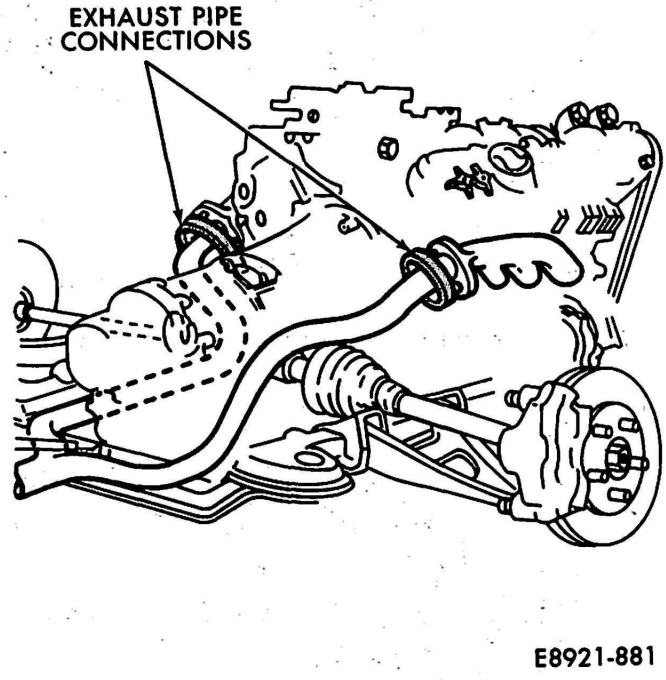


Fig. 11—Exhaust Pipe-To-Manifold Connection

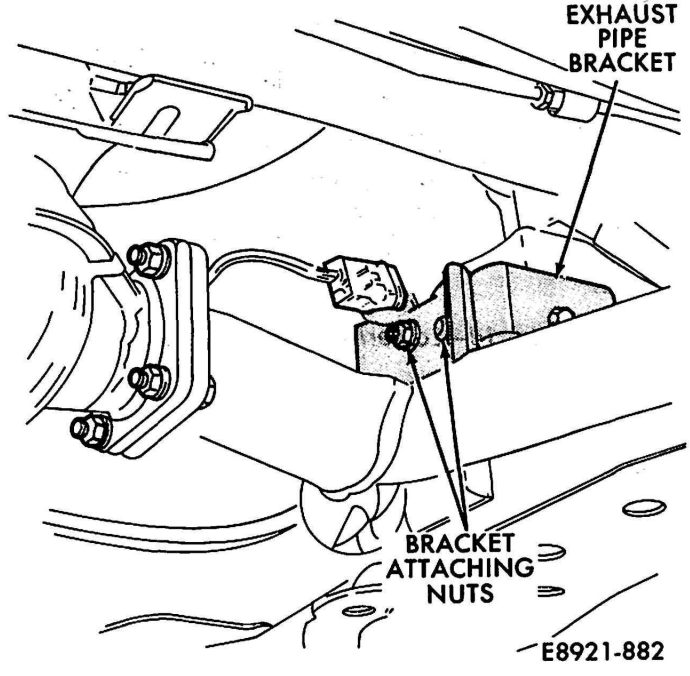


Fig. 12—Exhaust Pipe Bracket Nuts

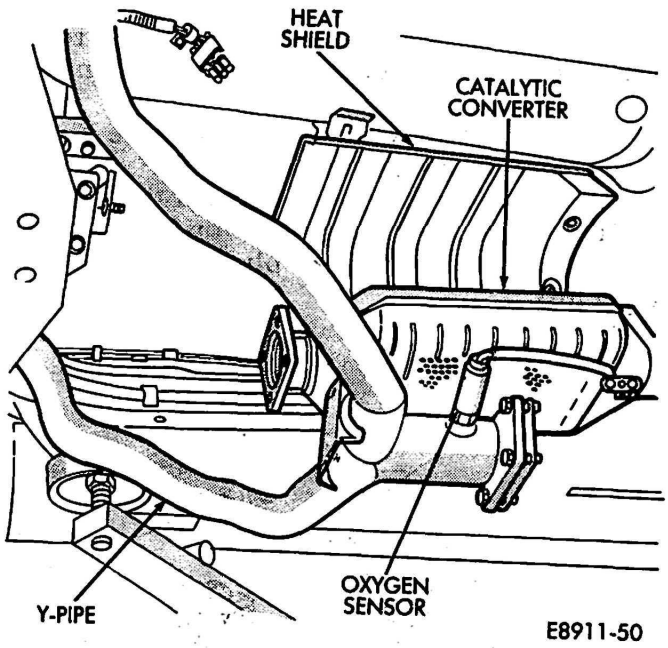


Fig. 13—Converter-To-Exhaust Pipe Connection

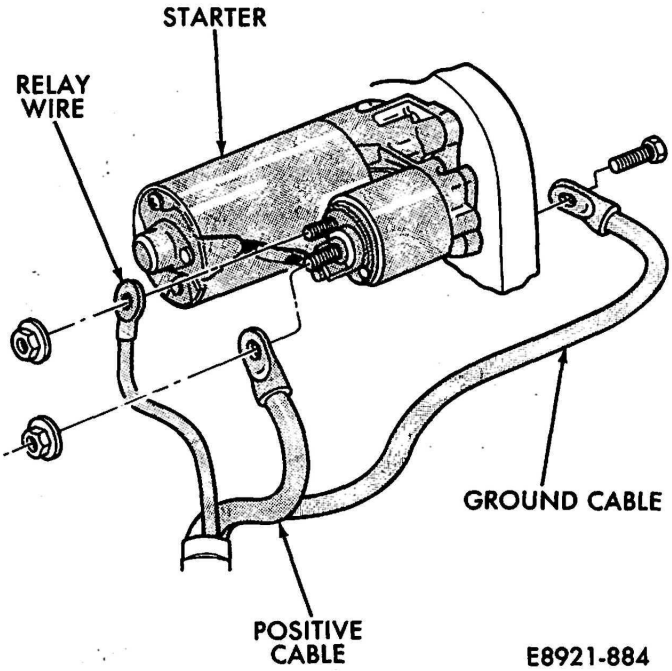


Fig. 15—Starter Connections

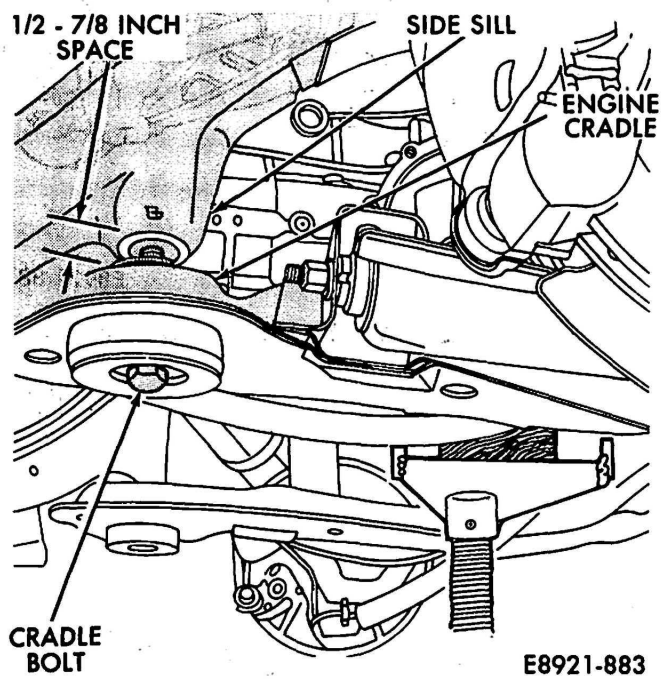


Fig. 14—Lowering Engine Cradle

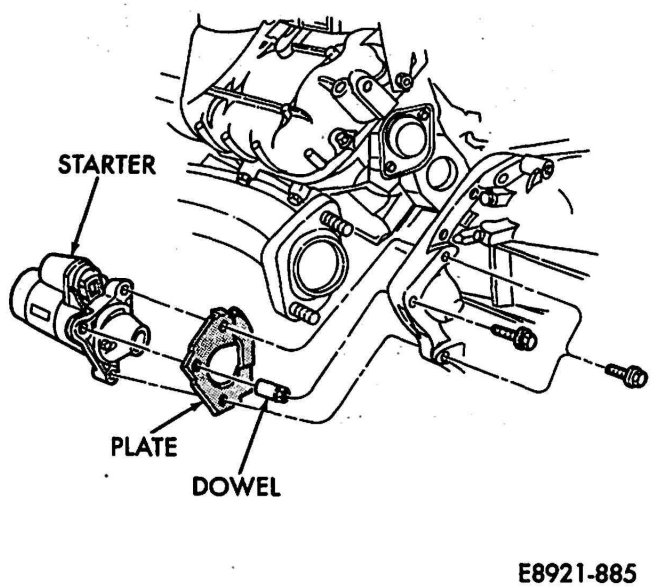


Fig. 16—Starter Removal/Installation

(35) Disconnect speedometer sensor wire and remove sensor (Fig. 22).

(36) Support transaxle with transmission jack (Fig. 23).

(37) Remove engine-to-converter housing stud nuts (Fig. 24).

(38) Remove remaining engine-to-converter housing bolts.

(39) Pull transaxle away from engine. Lower transmission jack and remove transaxle from under vehicle.

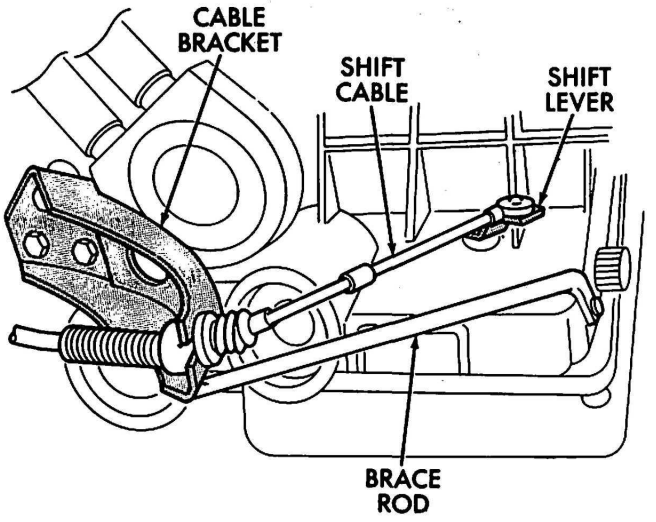


Fig. 17—Shift Cable, Bracket and Brace Rod

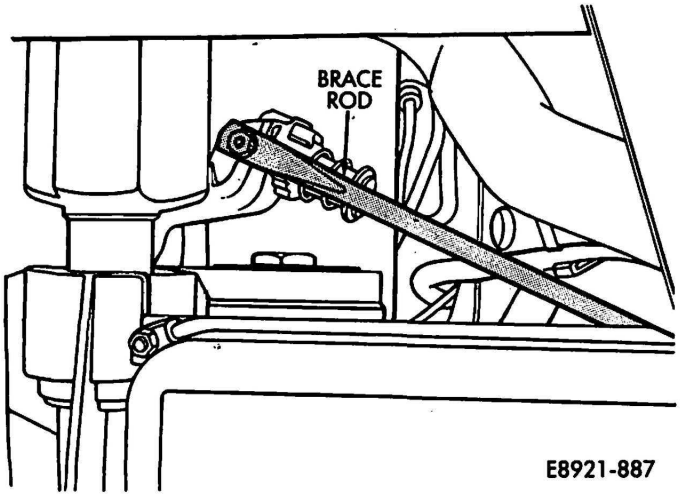


Fig 18. Brace Rod-To-Bracket Attachment (Front)

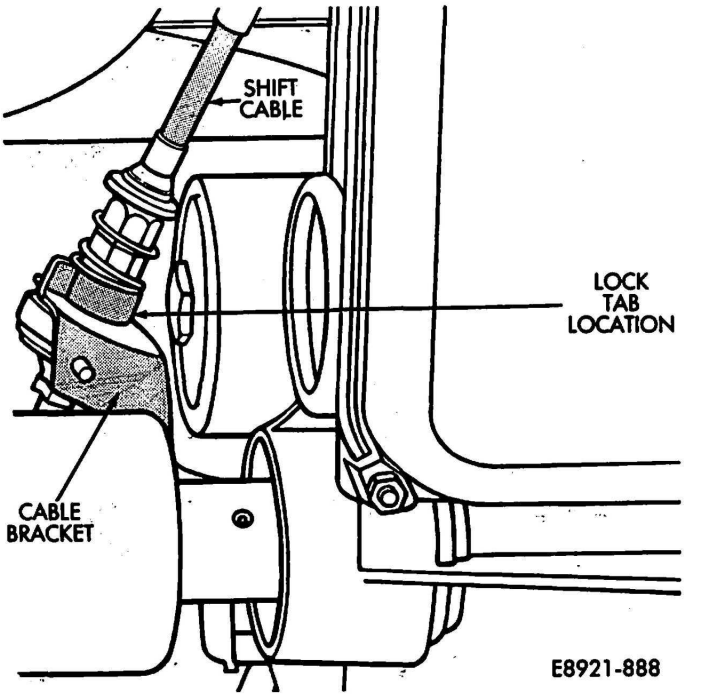


Fig. 19—Shift Cable And Bracket

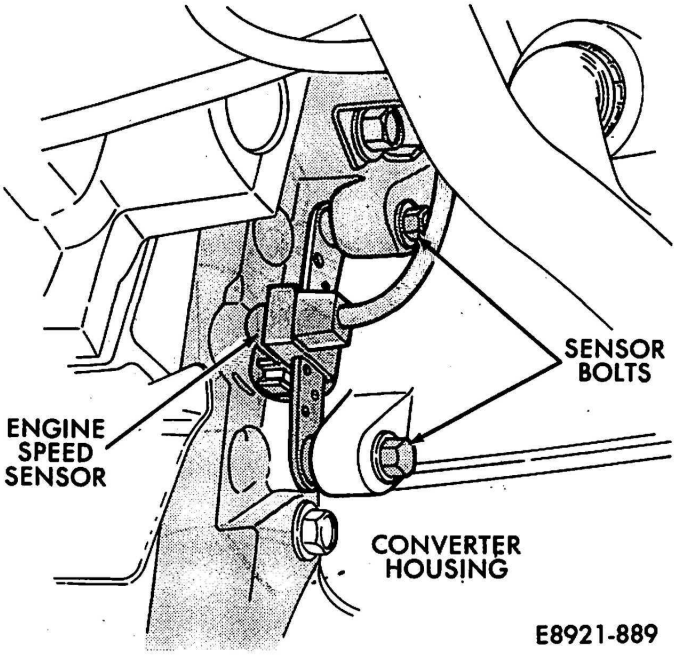


Fig. 20—Engine Speed Sensor

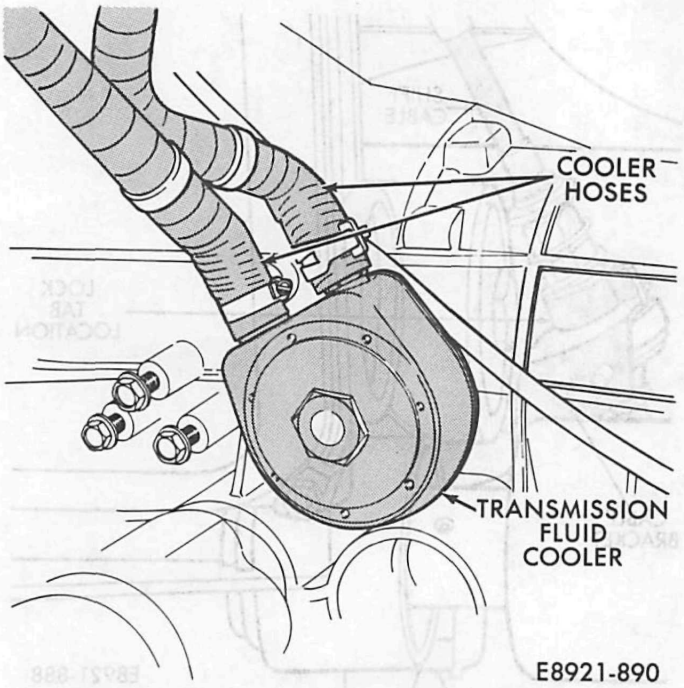


Fig. 21—Transmission Fluid Cooler and Hoses

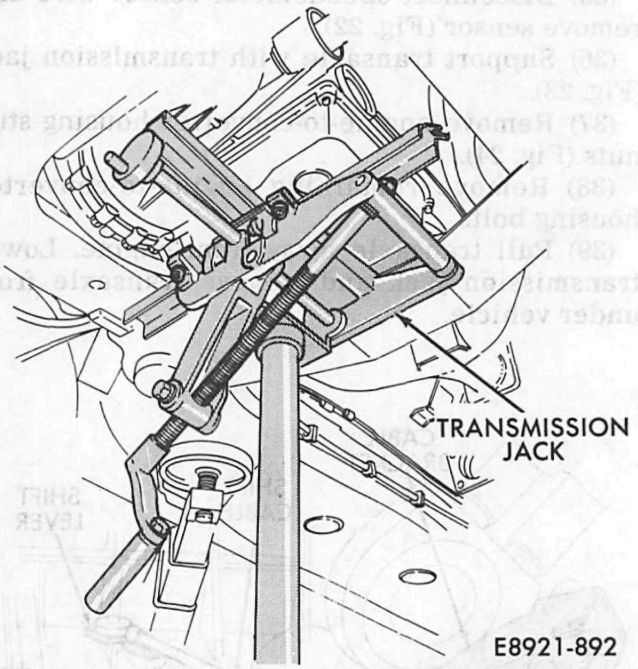


Fig. 23—Supporting Transaxle With Jack

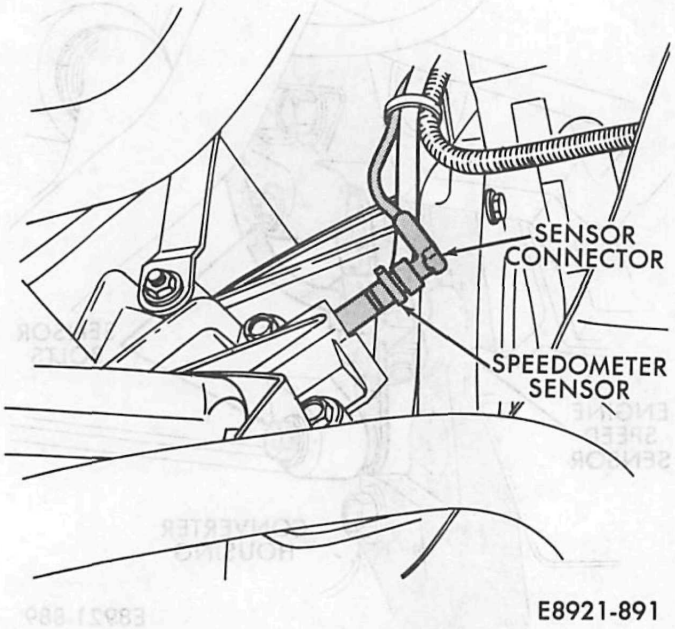


Fig. 22—Speedometer Sensor

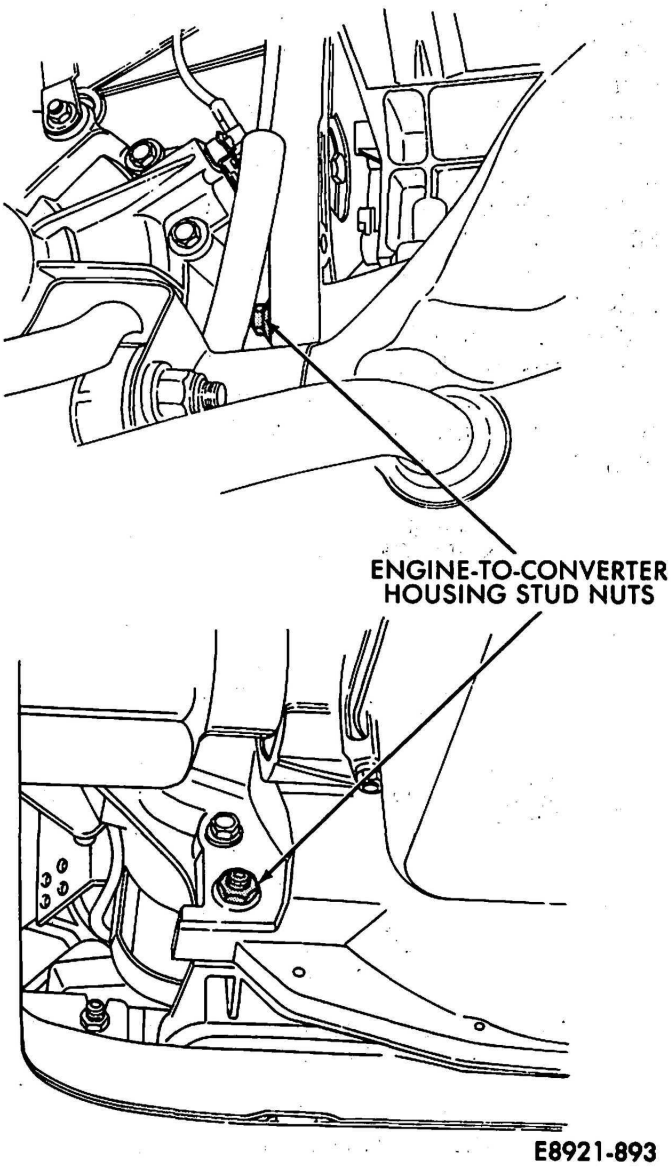


Fig. 24—Converter Stud Nut Locations

ZF TRANSAXLE INSTALLATION

(1) Inspect the converter drive plate. Replace the plate if warped, cracked, or damaged in any way.

(2) Coat torque converter pilot hub with bearing grease (Fig. 25).

(3) Raise transaxle on transmission jack (Fig. 23) and position transaxle on engine.

(4) Align converter housing with engine and seat transaxle on engine. Be sure transaxle is seated on the two engine alignment dowels.

(5) Install and tighten engine-to-transaxle attaching bolts to 43 N·m (31 ft-lbs) torque.

(6) Install and tighten the two mounting stud nuts (Fig. 24). Tighten nuts to 43 N·m (31 ft-lbs) torque.

(7) Install speedometer sensor (Fig. 22). Tighten sensor bracket bolt to 10 N·m (90 in-lbs) torque.

(8) Install hoses on transmission cooler and tighten hose clamps (Fig. 21).

(9) Install engine speed sensor (Fig. 20). Tighten sensor mounting bolts to 8 N·m (72 in-lbs) torque.

(10) Position shift cable bracket on transaxle (Fig. 17).

(11) Install and tighten shaft cable bracket bolts (8) to 14 N·m (125 in-lbs) torque.

(12) Install shift cable in bracket and connect cable to transmission shift lever (Fig. 17).

(13) Temporarily remove bolt securing neutral switch in case.

(14) Attach brace rod to shift cable bracket and to case (Figs. 17 and 18). Tighten bolt attach-

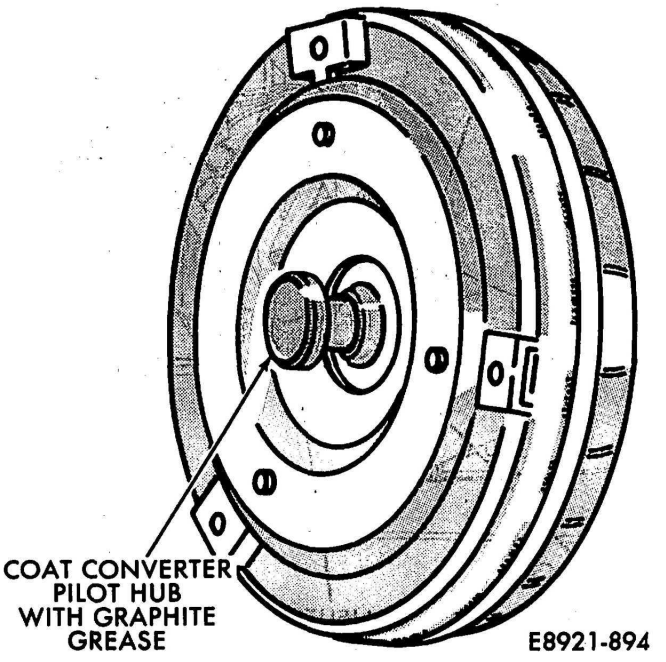


Fig. 25—Converter Pilot Hub Lubrication

ing brace rod to shift bracket to 10 N·m (90 in-lbs) torque.

(15) Install bolt that attaches brace rod to transmission case to 10 N· (90 in-lbs) torque. This bolt is also used to secure neutral switch in case (Fig. 26).

(16) Install starter, starter plate and dowel (Fig. 16). Tighten starter bolts to 42 N·m (31 ft-lbs) torque.

(17) Connect starter cables and relay wire (Fig. 15).

(18) Connect exhaust pipes to engine exhaust manifolds. Tighten exhaust pipe attaching nuts to 31 N·m (23 ft-lbs) torque.

(19) Install support bracket on transaxle (Fig. 10). Tighten bracket bolts to 40 N·m (30 ft-lbs) torque.

(20) Position exhaust bracket on rear cushion (Fig. 9).

(21) Install rear cushion and crossmember (Fig. 9). Align cushion in support bracket and install cushion-to-bracket bolt and nut. Do not tighten bolt at this time.

(22) Install but do not tighten exhaust bracket bolts (Fig. 9).

(23) Install new gasket on catalytic converter flange and connect converter to front pipe.

(24) Tighten the converter-to-front pipe attaching nuts to 34 N·m (25 ft-lbs) torque (Fig. 27).

(25) Connect oxygen sensor harness connector to sensor (Fig. 27).

(26) Tighten rear cushion-to-support bracket bolt and nut to 67 N·m (49 ft-lbs) torque (Fig. 28).

(27) Tighten bolts that attach exhaust pipe bracket to rear cushion to 31 N·m (23 ft-lbs) torque (Fig. 28).

(28) Install bolts and nuts attaching crossmember to studs on engine cradle (Fig. 29). Tighten bolts/nuts to 60 N·m (44 ft-lbs) torque.

(29) Tighten engine cradle-to-side sill bolts (Fig. 30) to 125 N· (92 ft-lbs) torque.

(30) Remove jack stand used to support transaxle (Fig. 30).

(31) Connect driveshafts to differential output shafts. Install shaft roll pins with pin punch.

(32) Apply Loctite 271 to driveplate-to-converter bolts and install bolts (Fig. 7). Tighten bolts to 33 N·m (24 ft-lbs) torque.

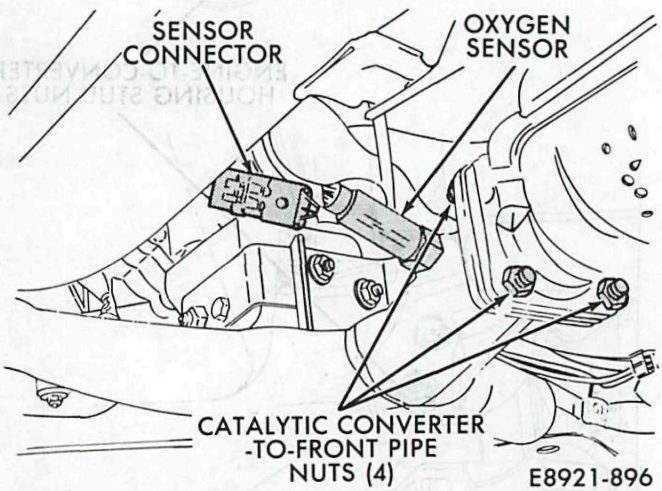


Fig. 27—Connecting Oxygen Sensor And Catalytic Converter

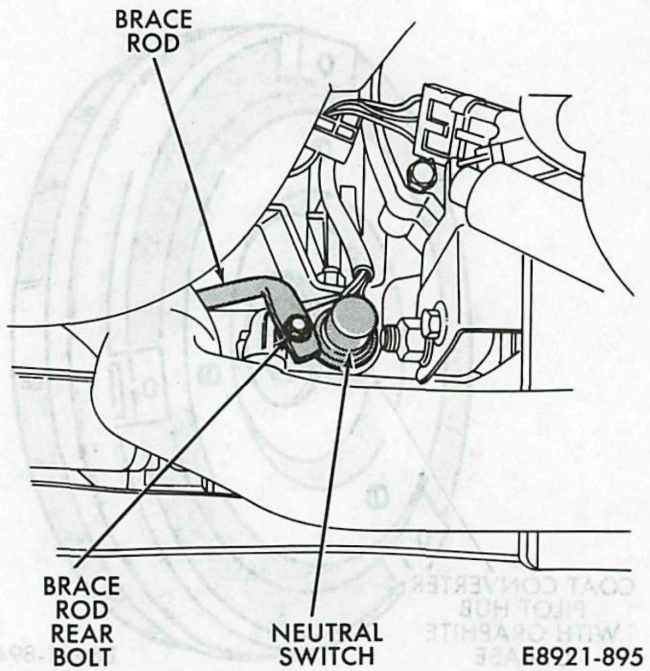


Fig. 26—Brace Rod And Neutral Switch Attaching Bolt

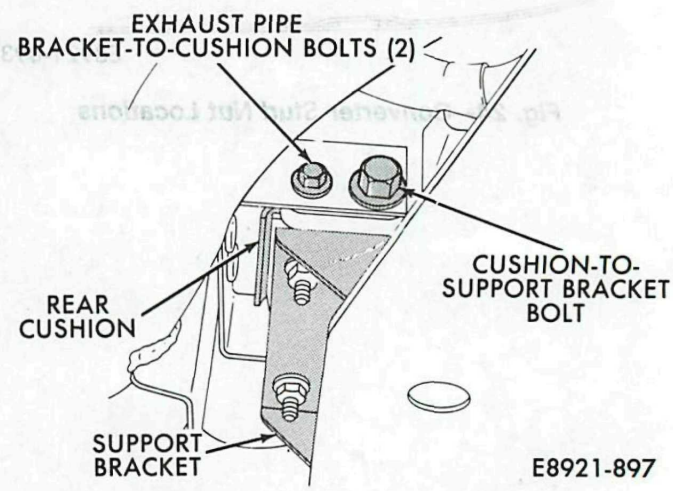


Fig. 28—Tighten Exhaust Bracket And Rear Cushion Bolts

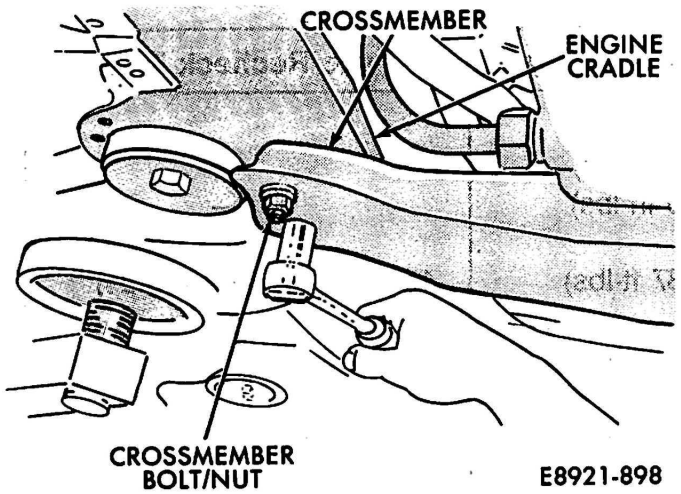


Fig. 29—Tighten Engine-To-Crossmember Bolts

(33) Install converter housing covers (Fig. 31).

(34) Tilt steering knuckles inward and into stuts. Tap splined steering knuckle bolts into place and install nuts on bolts. Tighten nuts to 200 N·m (148 ft-lbs) torque.

CAUTION: The steering knuckle bolts are splined. Hold the bolt head stationary with a wrench while tightening the nut. Do not attempt to turn the bolt head.

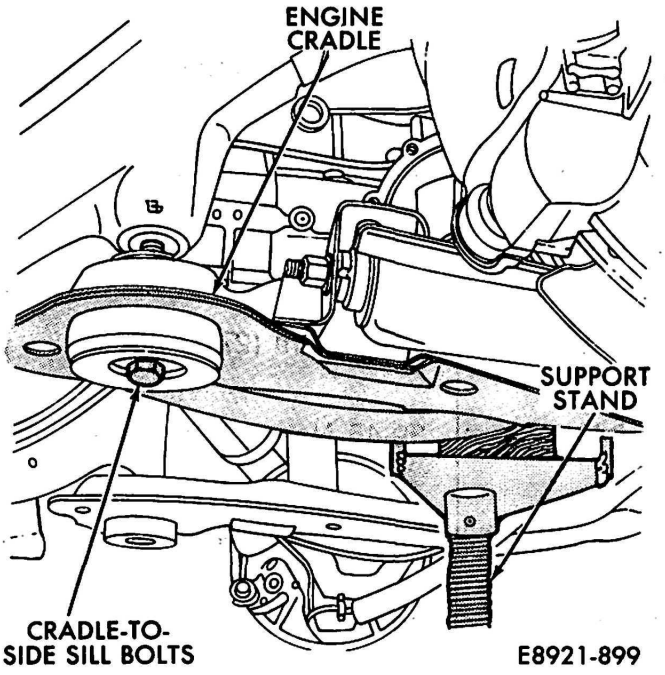


Fig. 30—Tighten Engine Cradle Bolts

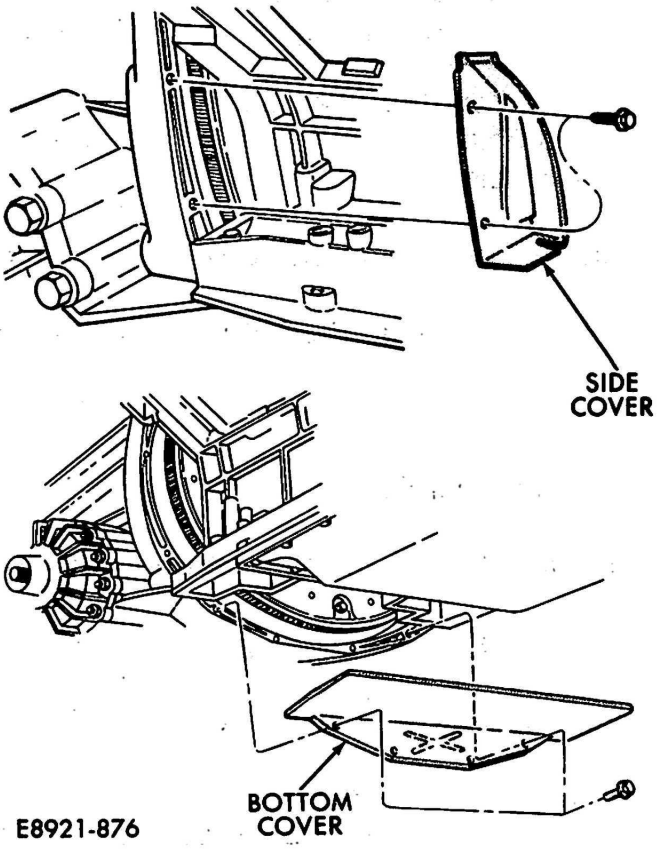


Fig. 31—Converter Housing Covers

(35) Install front wheels. Tighten lug nuts to 85 N·m (63 ft-lbs) torque.

(36) If necessary, add synthetic-type 75W-140 gear lubricant to differential.

(37) Install splash shield (Fig. 4). Tighten shield bolts to 28 N·m (21 ft-lbs) torque.

(38) Lower the vehicle.

(39) Attach throttle valve cable to engine bracket (Fig. 1).

(40) Connect the battery.

(41) Fill the transmission with Mopar-Mercon™ transmission fluid. Do not use any other type of fluid in the ZF transmission.

(42) Adjust the throttle valve cable. Refer to the procedure in In-Vehicle Service section.

(43) Adjust shift cable. Refer to procedure in this section.

Component	Service Set-to-Torque	Service Recheck Torque
Valve Body/Oil Screen Bolts:		
M6 Bolts	8 N•m (72 in-lbs)	—
M5 Bolts	5 N•m (45 in-lbs)	—
Transmission Oil Cooler Bolt	50 N•m (37 ft-lbs)	47-53 N•m (34-40 ft-lbs)
Oil Pan Retaining Bracket Nut	6 N•m (54 in-lbs)	5.5-6.5 N•m (50-58 in-lbs)
Detent Spring Bolt	10 N•m (90 in-lbs)	9-11 N•m (80-100 in-lbs)
Speedometer Sensor Bracket Bolt	10 N•m (90 in-lbs)	9-11 N•m (80-100 in-lbs)
Neutral Start Switch Bracket Bolt	10 N•m (90 in-lbs)	9-11 N•m (80-100 in-lbs)
Differential Cover Fill Plug	50 N•m (37 ft-lbs)	47-53 N•m (34-40 ft-lbs)
Transmission Shift Lever Nut	17 N•m (12 ft-lbs)	16-18 N•m (11-13 ft-lbs)
Rear Cushion-To-Rear Transmission Bracket Bolt/Nut	67 N•m (50 ft-lbs)	63-71 N•m (47-53 ft-lbs)
Exhaust Bracket-To-Rear Transmission Bracket Bolt	27 N•m (20 ft-lbs)	25-29 N•m (18-22 ft-lbs)
Exhaust Pipe-To-Pipe Bracket Nut	31 N•m (23 ft-lbs)	29-33 N•m (21-25 ft-lbs)
Exhaust Pipe-To-Manifold Nut	31 N•m (23 ft-lbs)	29-33 N•m (21-25 ft-lbs)
Rear Bracket-To-Transmission Case Bolt	40 N•m (30 ft-lbs)	37-43 N•m (27-33 ft-lbs)
Starter Retaining Bolts	42 N•m (31 ft-lbs)	39-45 N•m (28-34 ft-lbs)
Shift Cable Bracket-To-Transmission Case Bolt	21 N•m (15 ft-lbs)	20-22 N•m (14-16 ft-lbs)
Differential Cover Bolts	23 N•m (17 ft-lbs)	22-24 N•m (16-18 ft-lbs)
Throttle Cable Jam Nuts	15 N•m (11 ft-lbs)	14-16 N•m (10-12 ft-lbs)
Shift Cable Bracket Brace Rod Bolt	10 N•m (90 in-lbs)	9-11 N•m (80-100 in-lbs)

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Component	Service Set-to-Torque	Service Recheck Torque
Engine Timing Sensor Bolt	8 N•m (72 in-lbs)	7.5-8.5 N•m (66-78 in-lbs)
Oil Pan Retaining Clamp Nuts	6 N•m (54 in-lbs)	5.5-6.5 N•m (50-58 in-lbs)
Crossmember-To-Cradle Bolts	60 N•m (44 ft-lbs)	57-63 N•m (42-46 ft-lbs)
Transmission Bracket Bolt (Rear)	40 N•m (30 ft-lbs)	37-43 N•m (27-33 ft-lbs)
Transmission Rear Cushion-To-Rear Bracket Bolt	67 N•m (50 ft-lbs)	63-71 N•m (47-53 ft-lbs)
Wheel Nuts	85 N•m (63 ft-lbs)	82-88 N•m (60-66 ft-lbs)
Front Pipe-To-Catalytic Converter Nut	34 N•m (25 ft-lbs)	32-36 N•m (24-27 ft-lbs)
Exhaust Pipe-To-Manifold Nut	31 N•m (23 ft-lbs)	29-33 N•m (21-25 ft-lbs)
Descente Gear Housing-To-Transmission Case Bolt	23 N•m (17 ft-lbs)	22-24 N•m (16-18 ft-lbs)
Throttle Cam Bolt	5 N•m (48 in-lbs)	4.5-5.5 N•m (44-52 in-lbs)
Drive Plate-To-Crankshaft Bolt	68 N•m (51 ft-lbs)	65-71 N•m (48-54 ft-lbs)
Transmission-To-Engine Bolt	43 N•m (32 ft-lbs)	40-46 N•m (29-35 ft-lbs)
Torque Converter-To-Drive Plate	33 N•m (24 ft-lbs)	31-35 N•m (22-26 ft-lbs)
Dust Cover Bolts	12 N•m (110 in-lbs)	11-13 N•m (100-120 in-lbs)
Differential Fill Plug (M18 x 1.5)	50 N•m (37 ft-lbs)	47-53 N•m (34-40 ft-lbs)
Differential Drain Plug (M10 x 1.0)	25 N•m (18 ft-lbs)	23-27 N•m (17-19 ft-lbs)
Fill Tube To Retaining Nut Oil Pan	100 N•m (74 ft-lbs)	95-105 N•m (70-78 ft-lbs)
Fill Tube Bracket-To-Differential Cover Bolt	25 N•m (18 ft-lbs)	23-27 N•m (17-19 ft-lbs)

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WHEELS AND TIRES

CONTENTS

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GENERAL INFORMATION

Tires as defined below and described in Figure 1 are designed for the vehicle and provide the best overall performance for normal operation; the ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability traction, skid resistance and tread life. These tires have load carrying capacity, when properly inflated, to operate satisfactorily at all loads up to and including the specified Maximum Vehicle Capacity at all normal highway speeds.

Tires used at low speeds, in cool climates, and with light loads will have longer life than tires used for high-speed driving in hot climates with heavy loads. Abrasive road surfaces will accelerate tire wear.

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain, in most cases, much greater mileage than severe or careless drivers. Rapid acceleration and deceleration, severe application of brakes, high-speed driving, taking turns at excessive speeds, striking curbs and other obstacles are just a few of the driving habits which will shorten the life of any tire.

As longer wearing tires can be more susceptible to irregular tread wear, it is very important to follow the tire rotation interval shown in the section on Tire Rotation to achieve the tread life potential in these tires.

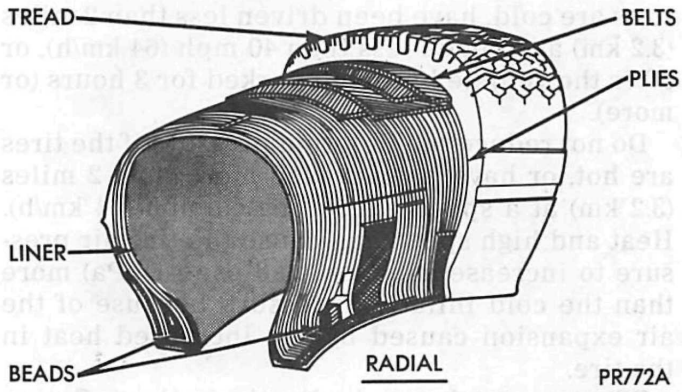


Fig. 1—Radial-Ply Carcass Design Tire

RADIAL-PLY TIRES

Radial-ply tires (Fig. 1) have belts circling the tire.

Body cords cross at right angles to the beads and radiate from center point of tire.

Radial-ply tires are identified by the letter R or by Radial on sidewall.

Radial-ply tires improve handling, tread life, and ride quality and decrease rolling resistance.

Radial-ply tires must always be used in sets of four and under no circumstances should they be used on the front only. However, they may be mixed with temporary spare tires when necessary, but reduced speeds are recommended.

Radial-ply tires have the same load carrying capacity as other types of tires of the same size and use the same recommended inflation pressures.

Inflation Pressures

The recommended inflation pressures for all load conditions are listed on the tire inflation pressure decal affixed to the driver-side door pillar.

When sustained, high-speed vehicle operation is anticipated, the tires can be inflated to the recommended inflation pressure plus an addition 2 psi (14 kPa). **The inflation pressure must never exceed the maximum recommended air pressure imprinted on the tire sidewall.**

Inflation Pressure Adjustment

Measure and adjust the inflation pressure when tires are cold, have been driven less than 2 miles (3.2 km) at a speed less than 40 mph (64 km/h), or after the vehicle has been parked for 3 hours (or more).

Do not reduce the inflation pressure if the tires are hot, or have been driven more than 2 miles (3.2 km) at a speed exceeding 40 mph (64 km/h). Heat and high speed can cause the tire air pressure to increase as much as 6 psi (41 kPa) more than the cold inflation pressure because of the air expansion caused by the increased heat in the tire.

When measuring and adjusting a tire inflation pressure, always use a reliable and accurate gauge to ensure the proper inflation pressure.

Spare Tires

The compact spare tire is designed for emergency use only. Operation at a speed exceeding 50 mph (80 km/h) and travel in excess of 50 continuous miles (80 km) is not recommended.

The correct compact spare tire inflation pressure is 60 psi (414 kPa).

Tread Wear From Both Shoulders

Rapid wear from both tread shoulders is usually caused by underinflation or an excessive mileage interval between tire rotation, or a combination of both incidents. If this type of wear occurs and the tires are serviceable, rotate and inflate with the recommended air pressure.

Tread Center Wear

Rapid wear from the tread center is usually caused by overinflation or an excessive mileage interval between tire rotation, or a combination of both incidents. If this type of wear occurs and the tires are serviceable, rotate and inflate with the recommended air pressure.

Cracked Treads

Cracked treads are usually caused by underinflation or excessive high-speed operation, or a combination of both incidents. Tires with cracked treads should be replaced and the replacement tires should be properly maintained to avoid a recurrence of the failure.

Tread Wear From One Shoulder

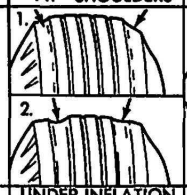
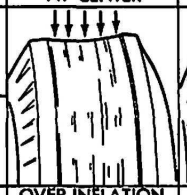
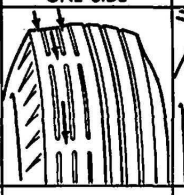
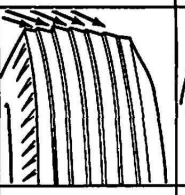
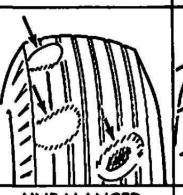
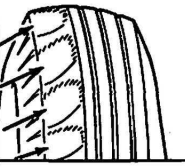
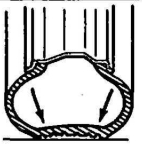
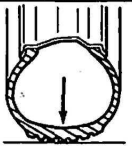
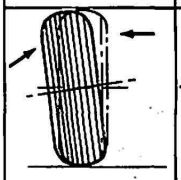
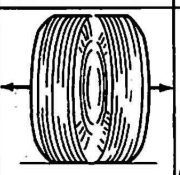
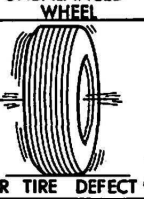
Excessive wear from one tread shoulder can be caused by excessive speed or turns or by an incorrect camber angle. An incorrect negative camber angle will cause excessive wear from the inside tire shoulder while an incorrect positive camber angle will cause excessive wear outside tire shoulder. If this type of tread wear occurs, measure the camber angle. If the camber angle is within the specified limits, caution the driver/owner about excessive speed when turning. If the tires are serviceable, rotate and adjust with the recommended air pressure.

Tread With A Feathered Edge

An incorrect wheel toe position will cause the tire tread surface to develop a feathered edge. One side of the tread will be rounded while the opposite side will have a feathered edge. This type tread wear indicates that the tire is side slipping and scuffing as it moves over the street/road surface.

A feathered tread edge that faces toward the vehicle indicates excessive toe-in. A feathered tread edge that faces away from the vehicle indicates excessive toe-out. The direction that a feathered edge has developed can be determined by moving your fingers over the tire tread surface. Bent strut brackets can also cause this type of tread wear.

If a feathered edge develops, measure and correct the toe position as necessary and rotate the tires if they are serviceable.

CONDITION	RAPID WEAR AT SHOULDERS	RAPID WEAR AT CENTER	CRACKED TREADS	WEAR ON ONE SIDE	FEATHERED EDGE	BALD SPOTS	SCALLOPED WEAR
EFFECT							
CAUSE	UNDER-INFLATION OR LACK OF ROTATION 	OVER-INFLATION OR LACK OF ROTATION 	UNDER-INFLATION OR EXCESSIVE SPEED*	EXCESSIVE CAMBER 	INCORRECT TOE 	UNBALANCED WHEEL  OR TIRE DEFECT *	LACK OF ROTATION OF TIRES OR WORN OR OUT-OF-ALIGNMENT SUSPENSION.
CORRECTION	ADJUST PRESSURE TO SPECIFICATIONS WHEN TIRES ARE COOL ROTATE TIRES			ADJUST CAMBER TO SPECIFICATIONS	ADJUST TOE-IN TO SPECIFICATIONS	DYNAMIC OR STATIC BALANCE WHEELS	ROTATE TIRES AND INSPECT SUSPENSION SEE GROUP 2

*HAVE TIRE INSPECTED FOR FURTHER USE.

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Fig. 2—Abnormal Tire Tread Wear Patterns

TIRE SERVICE

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INSPECTION

To maximize tire longevity, inspect tires frequently for the effects of incorrect inflation and other causes of uneven wear, which can also indicate a need for tire/wheel balancing, tire rotation or front-end alignment. Tires should also be inspected frequently for cuts, abrasions, stone bruises, blisters and for objects imbedded in the tire tread. More frequent inspections are recommended when extreme temperature changes occur and when the street/road surfaces are rough (or littered with debris).

For an additional visual reminder of tire condition, tread wear indicators are molded into the bottom of the tire tread grooves. These indicators appear in the form of 1/2 inch (13 mm) wide bands across the tread when it has worn down to a thickness of 1/16 inch (1.58 mm) or less. The tire should be replaced when these bands become visible (Fig. 1).

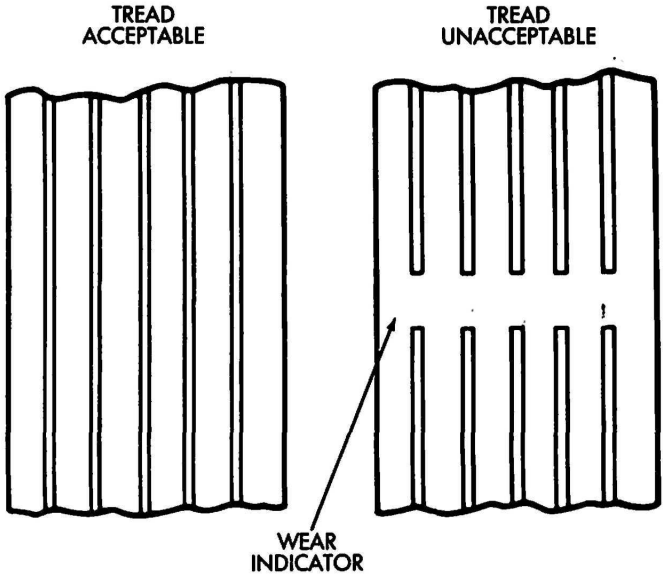


Fig. 1—Tire Tread Condition

CLEANING

Clean tires with a mild soap and water solution only and rinse them thoroughly with water. Do not use caustic solutions or abrasive materials. To clean white sidewalls and raised letters/numbers, use an approved whitewall cleaner only. Do not use steel wool, wire brushes or cleaning solutions that have a mineral oil base (e.g., gasoline, paint thinner and turpentine). These solutions are harmful to the tires and will also discolor white sidewalls and raised letters/numbers.

REPAIR

Punctured tires should be removed from the wheel and permanently repaired on the inside with a combination of a repair plug and a vulcanizing patch. When repairing punctures, always follow the manufacturer's instructions for a repair kit installation. Only punctures in the tread area are repairable.

Never attempt to repair punctures in the tire shoulders or sidewalls.

In addition, never attempt to repair any tire that has any of the following damage conditions:

(a) bulges or blisters
(b) ply separations
(c) broken, cut or cracked beads
(d) fabric cracks or cuts
(e) tread worn to the fabric or to the visible wear indicators
(f) punctures larger than 1/4 of-an-inch in diameter.

Externally applied repair plugs, blowout patches and aerosol sealants should be considered as emergency-type repairs only. Tires repaired by any of these methods should not be driven at a speed exceeding 40 mph (64 km/h) or for more than 75 miles (121 km) before permanent tire repair or replacement.

ROTATION

To equalize tread wear, tires should be rotated at the specified interval. The first tire rotation is the most important for establishing the prevention of uneven tread wear. After rotation, adjust the tire inflation to the recommended air pressures listed on the tire inflation pressure decal affixed to the driver-side door pillar.

The suggested method for tire rotation is the rearward-cross pattern (Fig. 2). This method is completely compatible with the tire industry's currently recommended procedure for cross-rotation of radial-ply tires. Other rotation patterns/methods can be used, but they may not necessarily provide all the tire longevity benefits that are derived from the "rearward-cross" pattern method (Fig. 2).

WIDE-TREAD TIRES

If used, radial-ply, wide-tread tires must be installed in complete sets and only when there is adequate clearance for the tire in the wheel well. **Tires with different widths must never be intermixed.**

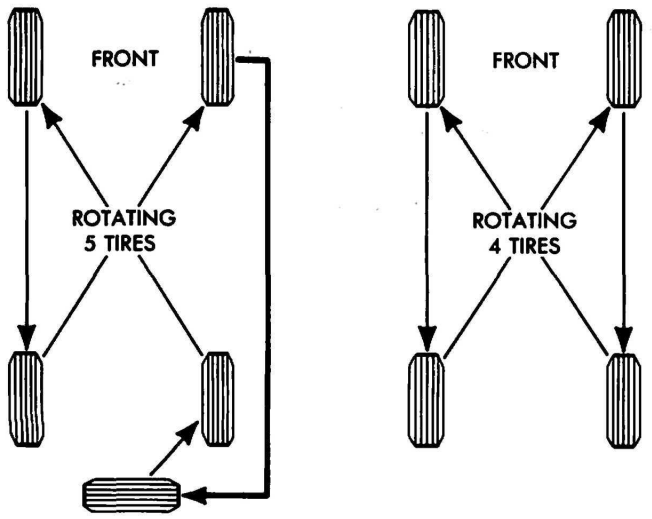


Fig. 2—Tire Rotation

CAUTION: The tires installed must all have the same circumference to maintain satisfactory operation. They must also be the same size, carcass construction and have the same inflation pressure. Intermixing tires of different size or carcass construction will cause unusual handling, noisy operation and accelerated wear of the drive shaft components.

TIRE DIAGNOSIS

General Information

Roughness, vehicle vibration, tire tramp, wheel shimmy, tire thump and wheel hop are usually the result of either excessive tire/wheel runout, cupped tires or tire/wheel unbalance. These problem conditions can also be caused by driving over rough or irregular street/road surfaces. Test driving a vehicle on different street/road surfaces will usually help determine if the street/road surfaces or the tires care causing the undesirable ride condition.

Always road test a vehicle to determine the exact nature of a problem. Drive the vehicle for at least 10 miles (16 km) to warm the tires and remove temporary flat spots that could have formed while the vehicle was parked. Note the tire condition and wear, and measure and adjust the inflation pressure before road testing.

Performance Characteristics

As a result of their unique construction, radial-ply tires have **ride, handling, and appearance** characteristics that are noticeably different from the other types of tires.

If the low-speed ride quality, or feel, of the tires appears harsh, this is a normal characteristic and is caused by the stiff belts used in radial-ply construction. Harshness often leads to the assumption that the tires are overinflated. Do not underinflate radial-ply tires in an attempt to correct this condition. Inflate radial-ply with the recommended air pressure only.

Because of the construction, radial-ply tires are sometimes less responsive to certain methods of wheel balancing. Radial-ply tire balancing is best accomplished using dynamic, two-plane, off-vehicle balancing equipment.

Tire Thump

Tire thump (noise) is caused by the tire moving over irregularities in the streets/roads or by irregularities in the tire itself. The thump sound coincides with each wheel rotation.

To identify the tire that is causing the thump, inflate all the tires with 45 psi (310 kPa) of air pressure temporarily and drive over the same streets/roads. If the thump noise does not exist, reduce the air pressure in one tire at a time repeat the road test. Each road test is accomplished with three of the tires with high air pressure and one with the recommended air pressure. When the thump develops again, the tire that was the most recently reduced to normal inflation pressure is the defective tire.

Tire Tramp/Wheel Hop

Tire tramp is caused by either tire/wheel static unbalance or by excessive tire/wheel lateral runout.

Static unbalance occurs when a disproportional amount of weight (mass) is concentrated at a small area on the tire/wheel. This causes a vibratory-type pounding action that is commonly referred to as tire tramp or wheel hop. Static balance is achieved by an equal distribution of weight (mass) around the circumference of the tire/wheel.

The most effective method of determining static unbalance is by the use of off-vehicle wheel balancing equipment.

DO NOT balance a tire/wheel that has been removed from a vehicle that has not been recently driven at least 10 miles (16 km) to eliminate any existing flat spot. The flat spot results from the weight of the vehicle being supported by a small area of the tire for an extended period of time. The extent of the "flat spot" on a tire is usually more severe during cold weather.

Wheel Shimmy

Wheel shimmy is caused by tire/wheel dynamic unbalance.

Dynamic unbalance results from unequal forces being concentrated at opposing locations on the circumference of the tire/wheel during wheel rotation. This condition causes wheel shimmy and vibration at medium and high wheel rotation speeds. Dynamic balance is achieved by an equal distribution of tire/wheel weight around the plane of rotation. This equalizes the forces and allows the wheel to rotate smoothly around the axis that bisects the tire and wheel center line.

Because balancing procedures vary with different types of equipment, follow the manufacturer's operating instructions.

Wheel Runout

Excessive radial or lateral runout of a wheel can cause roughness, vehicle vibration, tire tramp/wheel hop, excessive tire tread wear and wheel tremor.

Measure the wheel runout with either a dial indicator or with wheel alignment equipment.

The wheel radial runout is measured on the horizontal surface of the wheel **inside** rim (Fig. 3). The wheel lateral runout is measured on the vertical surface of the wheel inside rim bead flange.

The wheel radial runout should not exceed 0.9 mm (.035 inch). The wheel lateral runout should not exceed 1.4 mm (.055 inch).

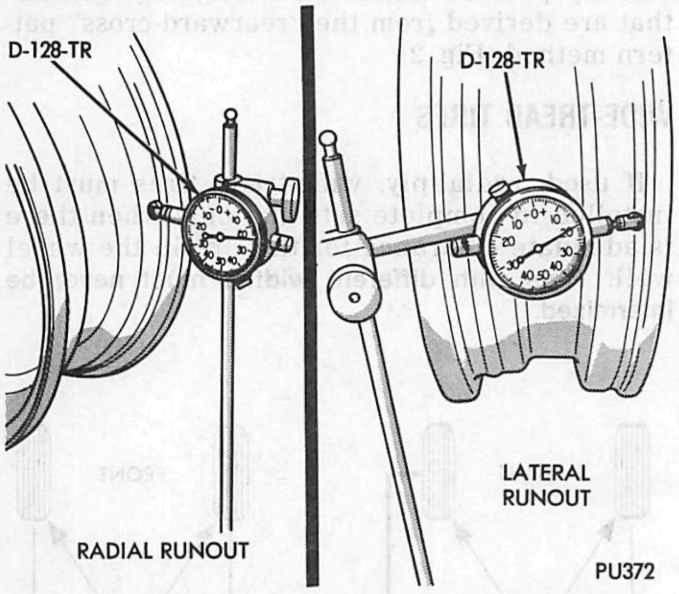


Fig. 3—Checking Wheel Runout

WHEEL SERVICE

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INSPECTION

The wheels should be inspected on a frequent basis. Replace any wheel that is cracked, bent, severely dented, has excessive runout or has broken welds. The tire inflation valve should also be inspected frequently for wear, leaks, cuts, and looseness. It should be replaced if defective or its condition is doubtful.

Clean all the wheels with a mild soap and water solution only and rinse thoroughly with water. Never use abrasive or caustic materials, especially on aluminum or chrome-plated wheels because the surface will be etched or the plating severely damaged. After cleaning aluminum or chrome-plated wheels, apply a coating of protective wax to preserve the finish and lustre.

Always tighten wheel lug nuts in a crisscross pattern (Fig. 1). Tighten steel wheel lug nuts with 85 N·m (63 ft. lbs.) torque. Tighten aluminum wheel lug nuts with 122 N·m (90 ft. lbs.) torque.

WHEEL BALANCING

Equipment and Precautions

Wheel balancing can be accomplished with either on- or off-vehicle equipment.

Use off-vehicle, two-plane balancing equipment when both static and dynamic balancing is required.

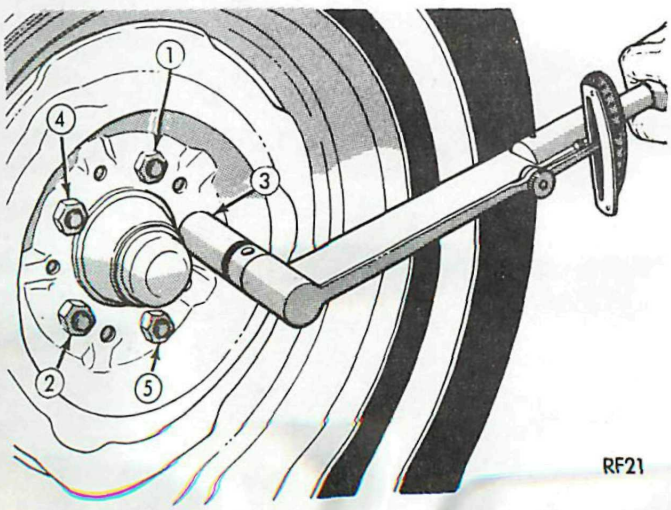


Fig. 1—Wheel Lug Nut Tightening

DO NOT balance a wheel and tire assembly that has been removed from a vehicle that has not been recently driven at least 10 miles (16 km) to eliminate any existing flat spot. The flat spot results from the weight of the vehicle being supported by a small area of the tire for an extended period of time. The extent of the flat spot on the tire is usually more severe during cold weather.

CAUTION: Raise and support both of the front wheels when using on-vehicle balancing equipment. In addition, do not support the vehicle with jack stands placed under the front suspension arms or the rear crossmember. Support the vehicle only at the lifting locations identified in Group 0.

Weights

When balancing aluminum wheels, use care to avoid damaging the wheel surface when installing the balance weights. Use only clip-on weights that are designed for aluminum wheels or self-adhering type weights on aluminum wheels and install them on the back side of the wheel (whenever possible).

Use standard clip-on weights for steel wheels.

BODY

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GENERAL INFORMATION

The procedures for maintaining "new vehicle" appearance are those most generally used. The final results may vary due to application of agents by persons inexperienced at this work and also from the type of foreign element on the material. For satisfactory results, appearance maintenance should be performed by experienced personnel using the recommended agents and established service procedures.

CAUTION: When using lacquers, thinners, or dyes the working area should be well ventilated, and consideration should be given to protective equipment.

SEALING

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GENERAL INFORMATION

To help save time, we've covered the most widely used methods of finding vehicle body leaks.

In addition to describing testing procedures, also included are a number of suggestions for pinpointing and fixing water, dust, and air leaks. These service hints are of a general nature, but common sense will suggest their application to specific cases.

Wind noise is the sound produced by air velocity or air turbulence to the extent that it is objectionable inside the vehicle. Wind noise and its cause varies between body styles and even from one body to another within a given style. What may be true on one body is not necessarily true on another.

PURPOSE OF SEALERS

Sealers are used to close openings in the body metal structure to prevent water, dust, noise and fumes from entering the body, and to prevent air from escaping from the body. Careful consideration has been given to all sealing problems. The importance of sealing becomes obvious when it is realized that a vehicle in motion creates a vacuum on the exterior, along the side glass and with the cowl vents open or the heater or air conditioning operating, the interior of the body is pressurized. This causes air to be forced from the vehicle where openings exist, creating an objectionable noise.

SERVICE PROCEDURES

WATER AND DUST LEAK TESTING

Preliminary Inspection

Before testing, look over the general area where the water or dust seems to be coming in. Check for things which are obviously wrong, like weatherstrips that have come loose, are torn or badly distorted. Look for gaps or holes at body joints or corners which should be closed up or sealed.

Traces of rust can be a sign of an open body seam, even though the opening is not visible. A small crack hidden by poor solder bonding at body joints. Partial adhesion or air holes in plastic sealing materials at body seams also accounts for some leaks.

In some cases, locate a water leak point by examining the door opening surfaces, especially after the vehicle has been driven in wet weather. Look at the dried road splash around the areas outside the weatherstrip contact line. If the weatherstrip's sealing properly, there will not be any trace of splash inside the contact line.

Alignment

When inspecting for visible defects, be sure to check the alignment of the door to see how well it fits in the opening. If the door is not lined up properly, or the latch striker needs resetting, the weatherstrip may not be able to make a good seal.

Where the door is properly fitted and aligned, the weatherstrip compresses when the door is fully closed. This compression allows the weatherstrip edge to make firm, even contact all around the door opening so it can seal without being crushed.

Don't try to compensate for poor door alignment by moving the striker inward. Such an adjustment may stop a leak temporarily, but it will also cause the weatherstrip to bottom out. With repeated crushing the strip will lose its resiliency and eventually break down.

As with door, checking for the obvious also applies to weatherstrips at the deck lid and liftgate. Here again, proper alignment and closing are basic requirements for good weatherstrip sealing, especially where a vehicle has had body repairs or glass replacement.

WATER LEAK TEST

Water testing for body leaks is simple to do and will help locate most leak points quickly. It also provides a proof-test of work after being fixed.

Other tests can be used for checking door, deck lid and tailgate weatherstrip sealing. However, water testing's the only practical way to check for leaks around the windshield, and rear window, at inner panel watershields, and at body joints or seams.

Windshield and Rear Window Leakage and Repair

The best location for water testing is a wash rack or similar place where the water runoff will not cause a mess. An air hose should also be available to dry off tested areas if repairs are to be made on the spot. Heat lamps are handy for drying wet spots, but must be used carefully to guard against electrical shock when working on wet floors.

Start water hose test, starting at the bottom center, move slowly toward the lower corner, up the side and across the top. On vehicles having a visible rubber weatherstrip, it may be helpful to isolate the leak as being either between the glass and rubber weatherstrip or between the rubber weatherstrip and the sheet metal. Do this by carefully aiming the water stream or by using masking tape so that water falls only on the glass side (or the sheet metal side) of the rubber weatherstrip. Stop when leakage appears inside. This method will pinpoint the leakage area. Dry off the area before applying sealer.

With Urethane Adhesive (tubes) P/N 4187061 or equivalent and an applicator gun Number (4371) or equivalent proceed to seal the area as follows.

(1) If a moulding and a weatherstrip is visible on the car, insert the applicator nozzle between the rubber and the moulding and squeeze a bead of sealer while moving the applicator along the periphery. Test with the water hose at the area of the problem. If the leak still exists, dry off the area and squeeze sealer between the glass and the rubber. Test with water hose. If the problem has not been corrected, remove the outer mouldings and inspect the area for moulding clip installation and gaps. Garnish mouldings may also have to be removed to locate exact location of leaks.

(2) If the car has no weatherstrip on the exterior windshield or rear window periphery, squeeze the sealer between the glass and the moulding. If the leak is not corrected, remove the outer moulding and inspect the area for moulding clip installation and gaps.

Water Hose Adjustment

Only a small stream of water is needed to find a leak. If too much pressure is used, the water can force past even a good-fitting weatherstrip.

It can also splash over the suspected area, so you'll have trouble finding the leak source.

The actual test is easy. Remove the hose spray nozzle and hold the pressure down to get about a three-inch stream. If a shut-off nozzle is used, adjust the flow to get the proper stream. The water will gush when it's turned on, so point the nozzle away from the test area to prevent overwetting.

Water Testing Doors

When ready to test, ask an assistant to sit in the vehicle and watch for water coming in as you work the hose around the gap at the door edge on the outside.

Start your check at the lower edge of the door and then work upward. If you begin water testing at the top, the runoff will wet the untested area and can make a leak hard to find.

If the weatherstrip doesn't seal properly, it's easy to see where the water comes in at the door edge. Mark the leak points with chalk or tape so you can find them when the door is open.

Corrections

Where the water leak test shows low spots at body solder or weld joints or other places around the door opening, you'll have to build up these low points.

Since there may be more than one leak, correct any leaks you find in lower areas before you test higher. Make sure the tested areas are dry and clean so any cement used in leak correction will stick tight.

If the water test shows the weatherstrip is sealing okay, run water along the side windows at the belt line weatherstrips, and check the inside trim panels for dampness, especially at the bottom. This water normally runs out of the door and body drains, however, the inside trim panel can get soaked if the plastic watershield under the trim is torn, missing, or not properly installed.

If a watershield is removed for any reason, its top and side edges should be recemented to the metal door or body panel in their original location. Cement the bottom edge of air shield on all others, before it is retaped. The bottom shield flap directs water splash to the drains, away from the inside trim panel.

TRUNK LEAKAGE

(1) First check to see if the deck lid is flush with surrounding metal surfaces.

(2) Then open trunk and see if the trough metal surfaces are bent or distorted. Check weatherstrip for splits, improper alignment or poor cement application. Then water test.

Where the water leak tests show low spots at body solder or weld joints or other places around the trunk opening, you'll have to build up these low points.

(3) If seams or pin holes are the cause of leakage, repair with an air dry sealant P/N 2654123 or equivalent sealer and touch up paint.

(4) If end extension or taillights are the cause of leakage, check first for loose or missing nuts, then apply dum-dum P/N 4026044 or equivalent on nut and stud.

(5) If leakage is not found in any of the above areas check the rear window lower corners for leakage.

TAILLIGHT TESTING

For further checking, move the hose down to the taillights. Flow on the water and watch inside the luggage compartment for leaks. Keep an eye on the taillight attaching studs and screws. Also make sure there's no water inside the taillight assembly.

On some models, unsealed body seams or holes in rear areas may let water or dust accumulate in taillight enclosures or quarter panel extensions. These accumulations can get into the luggage compartment, and of course, trapped water or damp dust can cause rusting on the inside of the enclosures.

COWL TESTING

The water test can also be used to check for leaks in the front or cowl area of the body. Raise the hood and flow water over the body seams, corner joints, bolt and plug holes in the cowl structure. Don't overlook the windshield wiper mounting seal and be sure to check the fresh-air inlets for evidence of leaks at plenum chamber seams.

Make sure the radio antenna lead-in grommet is in place, and pay close attention to body seams in the sides of the cowl section which are hidden by the fenders.

When checking for leaks in the cowl area, you'll have to remove inside trim panels at the front and sides to see where the water's coming in. It may also be necessary to remove heater or air conditioner parts to locate leaks in the fresh-air inlet plenum.

FLOOR PAN TESTING

A common result of body leaks is a soaked floor mat pad or carpet, and it's not unusual to find that the water is getting in through the floor pan to some other low point in the body. However, it is also possible for water to enter higher up and run downward to soak the mat.

Since a soaked mat should be removed for drying, it's a good way to start your check. Of course, mat removal means you'll have to take off door sill plates and pull out seats or seat cushion. But, this gives you a clear field for action so you can check body seam sealing and the plugs in the floor pan.

It's usually not practical to water-test for floorpan or wheelhousing leaks unless a special underbody water spray arrangement is available. As an alternate, the best way to locate these leak points is to look for rusty seam edges or other traces of leaks after the mats and cushions are removed. Traces of mud are an indication that the water is coming in from below.

BODY SEAM SEALING

When you inspect body seams and joints for leaks, don't assume that a generous coating or sealant automatically means a watertight seal. It only takes a small bubble of trapped air to cause a pinhole which can let in water and dust. In time, even a small leak can undermine heavy sealant applications. It is safer to clean off and reseal any doubtful spots in the sealant.

CHALK TESTING

Weatherstrips

Another weatherstrip leak check that's widely used is the chalk test. This test is easy and it's dry. Simply open the door and rub soft carpenter's chalk on the sealing surface of the weatherstrip all the way around. Blue chalk weatherstrip all the way around. Blue chalk shows up best on light-colored body paint, and white does the job for dark colors. If you can't get carpenter's chalk, ask for soft "chalktalk" chalk, or equivalent, at an art supply store. Regular hard blackboard chalk doesn't go on as easily and may not leave a good contact mark.

With the chalk applied, close the door in the normal manner and then reopen it. The chalk should transfer to the body surface contacted by the weatherstrip edge in a continuous, unbroken line if the seal's okay.

Wax Test

Should it be difficult to get a good chalk transfer, coat the body surface with a thin film of body wax where it is contacted by the weatherstrip. The wax will pick up chalk and leave a distinct imprint. The wax also removes chalk from the weatherstrip at the contact line so in effect, you have a double check. If rechalking is needed to get a more distinct transfer, you'll have to wipe off any wax which has transferred to the weatherstrip so the chalk can leave a good mark.

POWDER TESTING

White powder can also be used for leak testing around weatherstrips. Just like with chalk, the powder test is simple. All you need is the powder and a syringe, to blow it in around the door or deck lid. You can use white trace powder available from body sealing suppliers, or any fine dusting powder which will cling to painted body surfaces.

Application

Blow the powder between the weatherstrip and the edge of the door or deck lid, all around. If the powder leaves an unbroken line outside the weatherstrip, the seal is good.

If the test shows traces of powder inside the weatherstrip, or on its contact surface, the strip is not sealing properly at these points. The powder test sometimes shows up causes of leaks which are not easy to spot with water or chalk tests. After you test with powder or chalk be sure to clean up the test area.

WIND NOISE LEAK TESTING

Leaks which cause wind noises inside the vehicle seldom produce damage or the mess possible with water or dust leaks. However, a persistent wind noise can be very irritating.

Outgoing Air

Most wind noise is caused by air leaking out of the vehicle. When doors and windows are closed, and the cowl vents are open, or heater or air conditioning is on (not Max. A/C), forward motion of the vehicle pressurizes the interior, and a vacuum is created on the outside at the wide windows. In fact, with the fresh-air inlet doors

open, air can enter faster than it can leave, so pressure builds up inside.

Weatherstrip Seals

On all body models, if the weatherstrips seal properly, pressurizing the interior will not cause troublesome wind noises. However, any seal which does not make good contact can let the pressurized air force its way out in an area which causes objectionable noise.

Incoming Air

In addition to leaks in the outgoing direction, there is also wind noise caused by air which forces its way into the vehicle. Here, we usually find a gap or poor sealing condition which is often the same as one which allows drafts, water or dust to enter.

Turbulence

Turbulence outside the vehicle. This noise can be caused by loose moldings, moldings with protruding ends, gaps between trim moldings and rubber sealing strips, or incomplete drip rail sealing. Loose grilles, open bolt holes and radio antennas, have also caused whistling sounds when the wind has passed over them.

Correction

Use tape to close off suspected areas or to change their shape when hunting for the source of turbulence noise. Correction can be made if tape application changes the sound.

Road-Test for Wind Noise Leaks

As with water and dust leak testing, diagnosis of wind noise leaks should begin with a quick inspection for the obvious. Check weatherstrip condition, door and glass alignment. Look for poor-fitting moldings, and open holes or gaps. If all these are in order, the next step is a road test to locate the leak.

Road-Test Where It's Quiet

Try to make your road test in a low-traffic, open area where you can drive the car up to cruising speeds. This will let you check the effect of driving into and away from the wind, and also whether the noise changes when the wind is on opposite sides of the vehicle.

Preparation

To begin the test, close the doors and windows tightly. Make sure the radio and any blowers are shut off so they won't interfere with the test. Close heater or air-conditioner doors and open the outside air doors so body pressure can build up and start your test run. In cold weather, use heater blower on medium speed.

Inlet Doors Open—Outgoing Air

If you get the noise only when the air inlet doors are open, the sound is probably caused by outgoing air. This kind of noise may also vary as the vehicle speeds up or slows down.

Inlet Doors Closed—Incoming Air

Where the noise sounds off when the air inlet doors are closed, the noise is usually caused by air coming into the vehicle. If the air's leaking into the vehicle, the noise will be loudest on the windy side. Also you may be able to feel an air draft if the leak is bad.

No Change—Turbulence

When open and closing the fresh-air doors does not affect the noise, it's probably caused by turbulence somewhere outside the vehicle and may be hard to find.

Most Disturbing Level

Most causes of wind noise can be found in the upper areas of the vehicle sides, down to about a foot below the belt line, or across the windshield.

Pressure-Test for Wind Noise Leaks

Another way to check for wind noise leaks is to pressurize the body interior when the vehicle's standing still. You close the doors and windows tight, set the blower on high and move the controls to the defrost position. The fresh-air doors must be closed so pressure can build up inside the vehicle body.

Be sure to start the engine so there'll be vacuum to move the air damper doors to the defroster position. Then check outside the vehicle for escaping air around the door and window edges. Some air will escape even with proper sealing, but the amount should be limited.

Check the Bottom Last

In pressure-testing, the main concern should be with checking for leaks in the upper area of the

body. Be sure to check the rear door sealing at the "C" post.

BODY SEALING TIPS

A combination of common sense and application of the testing procedures should help locate most body leaks quickly. However, experience shows that leaks in certain areas are sometimes related to specific conditions which can be corrected without the need for testing. Here again, visual inspection should be the first step, but the evidence may not be as obvious as an open hole or a loose weatherstrip.

Clean the Area

As a final step in any body sealing job, make sure that you clean up the glass, weatherstrips, or other places which have been cemented or sealed.

REFINISHING PROCEDURES

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Base Coat/Clear Coat Finish

Vehicles today are sprayed in a hospital clean environment to eliminate dirt and foreign substances. The paint used is a two part application. The base coat which is applied on top of a special eight stage primer, gives the vehicle its color. After the color (base coat) is applied, a special spray gun, called a turbo-bell, sprays the clear coat (topcoat) on the vehicle. This clear coat gives the paint finish its high gloss and durability.

To determine correct color and part number of enamel used on the vehicle, refer to code on body number plate and then locate corresponding code on paint chart. Proper safety equipment should be used and work should be done in a well ventilated area.

DEFINITIONS OF TECHNICAL TERMS

Single Coat

A single coat is a spray pattern applied from left to right. The returning right to left pattern is applied so that it covers approximately half of the preceeding pattern. This process is repeated until coverage of the panel is complete.

Double Coat

A double coat is a spray pattern applied from left to right then back again over the same area. A panel is covered by overlapping each double coat by at least 50%.

Drying

Drying or hardening of a film goes through several stages. **First** is known as "dust free" and is the time required for a film to reach the condition where, if any dust settles on it, dust will not become imbedded, but may be wiped off after film has hardened. **Second** stage is known as "tack free" and is the time required for a film to reach the condition where it may be touched with light pressure of finger. **Third** is "hard dry" and is the time required for film to become thoroughly hard so that it may be rubbed and polished.

Degrease—Dewax

This is wiping with a clean cloth saturated with a commercial cleaner. Essential to good paint adhesion.

Featheredging

This is tapering of edges of a finish so that when a finger is passed over it no break will be felt. Featheredging is usually done with water and sandpaper on a sanding block. This term applies to the sanding of a defect in the prime or color coat.

Ferrous and Non-Ferrous Metals

Ferrous metals are those which are made from iron (steel). Nonferrous metals are those which are not made from iron or do not present an iron (steel) surface, such as aluminum, aluminum alloys, brass, copper and magnesium.

Flash Time

This is the time required for an applied coat of paint to lose most of its solvent.

Mist Coat

This is over thinning the color and spraying wet. Usually the final coat.

Priming

The function of a primer is to act as a surfacer for the finished color coat. It also forms a bond between the metal surface and the color coat.

A glazing putty is used for filling in small imperfections which are too deep to be taken care of by surfacer coats. It may be applied either before or after the last coat of primer surfacer.

Reducers

Reducers are mixtures of volatile liquids used to reduce alkyd and synthetic primers and enamels to the proper consistency for application.

Sanding Block

As a rule a sanding block is a flexible rubber block, to which sandpaper may be fastened. It offers a good grip for the operator.

Wherever possible sanding should be done with a block as it distributes the pressures and gives a more uniform surface.

Surfacing

The function of a surfacer is to prepare a smooth surface for the color coats.

Tack Rag

This is a piece of cheesecloth that has been dipped in thin, nondrying varnish and then wrung out. It is kept in a container so that varnish will not harden but will remain tacky. Tack rag is used to wipe off a surface to remove dust and lint.

Thinners

Thinners are mixtures of volatile liquids used to thin lacquer type finishing materials to proper consistency for application.

Undercoats

All products used to prepare the surface to receive color coats are classified as undercoats, such as primers, surfacers, putties, primer surfacers and sealers.

PAINT REPAIRS ON GALVANIZED METALS

To perform paint repairs on galvanized rocker panels or any other galvanized steel surfaces, care must be exercised when preparing bare galvanized surface to properly accept primer surface and finish paint. Do not use short cut methods nor inter mixing of materials.

Metal Preparation

(1) Wire brush or steel wool entire metal surface and remove all grease or oil, with wax and grease remover.

(2) Thoroughly sand affected area to remove all corrosion products from exposed metal surface while carefully feathering all paint edges.

(3) Treat bare metal panel with a conditioner according to label directions.

(4) Rinse with clean water and blow off with compressed air.

Refinishing

(1) Apply one light coat of primer for adhesion.

(2) Apply primer surfacer if required.

(3) Sand when dry and proceed with application of finish coats according to paint manufacturers recommendations.

RUST PROTECTION

Prior to applying any paint to the sheet metal clean the area to be repainted.

Eliminate all fingerprints, chemically treat all bare metal.

This conditions the exposed metal to resist rust.

BUFFING AND POLISHING

Minor imperfections in paint finish normally can be removed by sanding, buffing and polishing. The following procedure should be used when working on these minor conditions:

(1) Wet sand by hand affected area using #600 paper which has been soaked in mineral spirits. Caution should be used not to rub too hard over any of the affected areas or on ridges.

(2) Remove sand sludge.

(3) Tack off area with a clean, soft cloth.

(4) Buff entire area using a fine buffing compound.

COLOR SANDING, BUFFING, AND POLISHING

(1) Wrap a piece of 600 grit or finer wet or dry sandpaper around a two inch by three inch (2 × 3) rubber squeegee.

(2) Apply a few drops of mineral oil or water over and around the paint condition. (Baby oil can be substituted for mineral oil).

(3) Sand the paint condition in a light circular motion in order to just sand the top of the orange peel. Use rubber squeegee to check the sanding operation after three or four passes, making certain not to over sand.

(4) Use a buffing machine with a cutting pad and very fine compound to buff out the sanding marks.

(5) Either by hand or machine, remove wheel marks with a cleaner and polisher and detail work area until clean.

COLOR COATING PROCEDURE FOR PAINTING SECTIONS OF A PANEL—USING ACRYLIC ENAMEL

(1) Dewax and degrease complete panel by using correct solvents. Follow instructions and procedures printed on label of product being used.

(2) Sand the area to be repaired to within 1/16 or 1/8 of an inch of breakline or breaklines. 360 or 400 grit wet sanding paper can be used or 280 or 320 grit dry sanding paper can be used.

(3) Use blow gun with approximately 30 pounds air pressure and a good tack rag to remove dust and dirt from complete work area and adjacent panels.

(4) Apply 3/4 inch masking tape to the breakline or breaklines and allow approximately 3/16 of an inch of the tape to "over lap" the breakline or breaklines, then use the finger to fluff upward this 3/16 of an inch portion tape. Complete the masking operation with paper and tape to cover adjacent panels.

(5) Mix the color well in a paint shaker and cut the color with the correct solvents in a container which has marked measurements so as to follow the manufacturer's instructions on how their materials should be used.

(6) Adjust air pressure at the air regulator only—not by air restrictor or kinking the 5/16 I.D. hose which should have large I.D. fittings.

(7) Apply the color with a good spraying technique, not twisting the wrist, until coverage and match is accomplished.

(8) Remove the masking when cured or dry and clean up or detail as necessary.

PREPARING THE SURFACE FOR PAINT

This operation is the backbone or foundation for finish color. It primes metal to insure adhesion and fills minor surface imperfections.

(1) Degrease and dewax the metal.

(2) Apply self-etching primer.

(3) To build substrate back to original thickness use a high blend primer.

(4) Sand undercoats (refer to paint manufacture for recommended sandpaper grit).

(5) Respray with primer surface until the undercoat meets its original thickness.

(6) Resand undercoat with manufactures recommended sandpaper.

(7) Reclean surface.

(8) Remove overspray from exterior and apply sealer recommended.

(9) Tack rag entire surface to remove lint and dust.

(10) Mix base coat.

(11) Apply base coat with light single coats. Allow for proper flash-off. Note: Apply sufficient amount of base coat to achieve coverage. If coverage is difficult to determine, tape on an opacity card on masking paper next to the surface to be painted.

(12) Allow proper dry time for base coat. Note: Do not use tack rag to remove dirt from base coat. This will only disturb the unprotected metallic flake and increases the dirt problem.

(13) Mix the clear coat according to manufactures recommendations.

(14) Apply clear coat with light single coats. Allow for proper flash-off.

(15) Apply sufficient amount of clear coat to duplicate O.E.M. finish.

(16) Clean spraying equipment and detail car for customer pick-up.

COLOR APPLICATION

The most important step in color coat application is to follow the manufacturers instructions for the product being used. Similar products from different manufacturers will generally require different methods of application. Specific instructions on line pressure, coverage, thinning, etc. are usually available from paint supply manufacturers.

Metallic Color and Pearl Coats

Metallic color can appear to vary in richness. Variation can be described as:

A closed pattern that appears lighter with fine metallic dispersion.

An open pattern that appears rich with metallic flakes less noticeable.

An open pattern is achieved by lowering air pressure to 20-30 lbs. at gun, reducing acrylic lacquer color 100% with a blend of acrylic lacquer thinner and all purpose retarder.

FLEXIBLE PANEL REFINISHING

(1) Clean all surfaces with a wax and grease remover such as DX-330 ACRYLI-CLEAN or equivalent.

(2) Sand surface with #400 sandpaper and reclean surface as per step 1.

(3) Apply one full wet coat.

(4) Allow 10 to 15 minutes flash time.

(5) Apply a final full wet coat.

(6) Allow to dry 2 to 3 hours.

Flexible Panel Repair

It may not be necessary to replace a damaged flexible panel. Flexible panels are repairable using a product such as 3M 8101 Structural Adhesive or equivalent. For best results follow manufacturers instructions.

PAINTING PLASTIC COMPONENTS

To paint plastic trim components it is necessary to:

- Identify the type of plastic to be painted.
- Follow procedures recommended for the different types of plastics.

To determine which plastic is being used, cut a small sliver of plastic from the backside of the part to be painted. Hold the sliver in needle nose pliers and burn the plastic (Fig. 1).

(1) The ABS (acrylo-nitrile/butadiene/styrene) group will burn with a heavy black smoke.

(2) The polypropylene group burns with no readily visible smoke.

(3) Nylon can be identified by the distinct odor of burning wool during the burn, rather than by the color or intensity of the smoke.

(4) The vinyl group will burn with a blue green tint.

To test for vinyl, heat a piece of copper wire red hot. Immediately apply the wire end to a nonvisible portion of the plastic until a glob of plastic adheres to the wire. Place the glob into the flame and observe the color.

The following chart shows the types of plastics commonly used on trim components, and the procedure to follow.

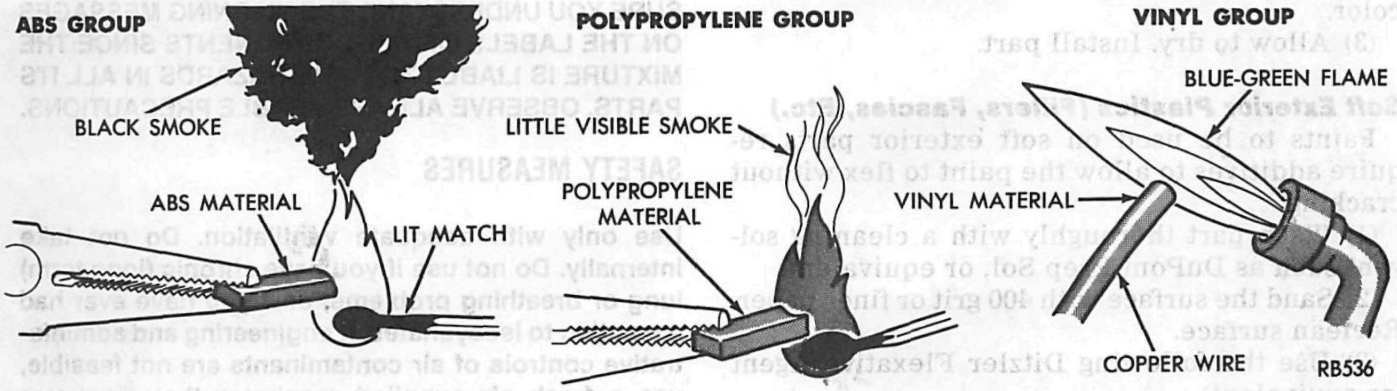


Fig. 1—Flame Test to Identify Plastic Materials

Plastic Type	Examples	Painting Procedure
Rigid Vinyl	Bumper Fillers	Flex Agent Required
RIM Urethane (Reaction Injection Moulding)	Fascias	Flex Agent Required
TPU (Thermoplastic Urethane)	End Caps Soft (Same as RIM)	Flex Agent Required)
TPO (Thermoplastic Olefin)	Bumper Fillers	Flex Agent Required
FRP (Fiberglass Reinforced Polyester)	Nose Cones (Hard)	Same as Steel
Phenolic	Ash Trays	Same as Steel
Nylon	Spoilers, Louvers	Same as Steel
ABS (Acrylo-nitrile/Butadiene/ Styrene	Louvers	No Flex Agent
Polypropylene	Hard Seat Back, Garnish Moulding	No Flex Agent
Flexible ABS	Dash	No Flex Agent

Rigid ABS

Rigid ABS required no primer. The appropriate paint will adhere satisfactorily to this plastic.

(1) Wash part thoroughly with a cleaning solvent such as DuPont Prep Sol, or equivalent.

(2) Color coat the part, using the appropriate color.

(3) Allow to dry. Install part.

Soft Exterior Plastics (Fillers, Fascias, Etc.)

Paints to be used on soft exterior parts require additives to allow the paint to flex without cracking.

(1) Wash part thoroughly with a cleaning solvent such as DuPont Prep Sol, or equivalent.

(2) Sand the surface with 400 grit or finer paper. Reclean surface.

(3) Use the following Ditzler Flexative Agent (or equivalent).

(a) Mix DDL (Duracryl acrylic lacquer and Flexible additive (DX-1798) and Duracryl lacquer thinner (DTL) as follows:

Duracryl Acrylic Lacquer DDL	Flexible Additive DX-1798	Duracryl DTL Thinner	Yield
1 pint or 8 ounces	1 pint or 8 ounces	1-1/2 pints or 12 ounces	3-1/2 pints 1-3/4 pints

(b) Mix in the Duracryl (DDL) color and Flexible additive (DX-1798) thoroughly before adding the Duracryl thinner (DTL) best suited for the ambient temperature.

(c) Apply a minimum of eight to ten wet double coats,* allowing flash time between double coats. Use 30-35 pounds air pressure at the gun. As the film builds heavier, it will be necessary to allow longer flash off times between double coats to avoid trapping thinner. Trapped thinner can result in pinholing or bubbling.

Most colors will have adequate hiding after applying the minimum number of double coats. Some deep look colors may require additional double coats.

(d) Air dry for approximately four hours at 70°-85°F before installing or putting into service.

The new finish is naturally soft and pliable. When the proper Duracryl thinner (DTL) is used for the prevailing temperature, the finish should have adequate gloss. If compounding is desired, a minimum of two weeks should be allowed. Use only DXR-25 (a fine hand rubbing compound) or DRX-16 compound with a power buffer using only a very light pressure.

*See "Definitions of Technical Terms" on first page of "REFINISHING PROCEDURES".

WARNING: BECAUSE OF THE NATURE OF THE PRODUCTS SHOWN IN THESE FINISHING SYSTEMS, THEY MUST BE BLENDED WITH OTHER COMPONENTS. BEFORE OPENING THE PACKAGES, BE SURE YOU UNDERSTAND THE WARNING MESSAGES ON THE LABELS OF ALL COMPONENTS SINCE THE MIXTURE IS LIABLE TO HAVE HAZARDS IN ALL ITS PARTS. OBSERVE ALL APPLICABLE PRECAUTIONS.

SAFETY MEASURES

Use only with adequate ventilation. Do not take internally. Do not use if you have chronic (long term) lung or breathing problems, or if you have ever had a reaction to isocyanates. If engineering and administrative controls of air contaminants are not feasible, use a fresh air supplied respirator that respirator supplier recommends as effective for isocyanate vapors and mists. Follow directions for respirator use. Wear the respirator for the whole time of spraying and until all vapors and mists are gone. Avoid breathing of vapor or spray mist. Avoid contact with eyes and skin.

PAINT BAKE OVEN TREATMENT (WITH TEXTURED GRILLES)

To avoid warpage, all models with textured grilles and bezels should be covered with paper or other material to shield grille assembly from heat before vehicle enters paint bake ovens, or be completely removed from vehicle.

FIBER GLASS FINISHES

Fiber glass should be treated much the same as body steel; however, it is a noncorroding material and does not require chemical conditioners.

Replacement or new panels may contain silicone oils on the surface due to the manufacturing process used. These oils must be removed from the surface, to prevent cratering of the freshly painted surface.

Fiber Glass Surface Preparation

Under most repair situations when working with fiberglass, the working area should be well ventilated, and consideration should be given to protective clothing. Respiratory masks and safety glasses should also be worn.

The procedure does not represent a complete fiber glass repair, but does reflect the basic steps to be taken in the repair.

(1) In a well ventilated area, using alcohol, wash new molded parts liberally with a clean cloth.

(2) Thoroughly clean the surface with wax and grease remover.

(3) Reclean surface and wipe dry with clean rags.

(4) If there are joints to be filled or the sanding operation exposes air pockets or glass strands, glaze a coat of body filler over the entire surface.

(5) Allow to cure, sand and reclean.

(6) Apply primer or surfacer as directed.

(7) Allow to dry and sand smooth with fine sandpaper to minimize sand scratches.

(8) Blow surface off with air and tack rag the surface.

(9) If enamel top coats are to be used a synthetic primer surfacer is also recommended.

(10) Apply color coats as recommended, by manufacturer.

CORPORATE IDENTITY CODE

Corporate White—8367 Corporate Blue—12785 Corporate Red—71831

The first two digits are accent or roof color. The second two digits are basic body color.
For special colors (coded 999) finish Special Order (SO) Number.
Painted grilles are painted in exterior colors.

EXTERIOR PAINT

Paint Code	Color Name
HR1	Exotic Red Clear-Coat
HM2	Dark Cherry Pearl-Coat
HF5	Dark Driftwood Metallic Clear-Coat
HY3	Sand Metallic Clear-Coat
HQ9	Dark Baltic Blue Metallic Clear-Coat
HQ1	Platinum Blue Metallic Clear-Coat
DX8	Black Clear Coat
HS3	Dover Gray Metallic Clear-Coat
HA2	Sterling Silver Metallic Clear-Coat
GW7	Bright White Clear-Coat

INTERIOR COLORS

Paint Code	Color Name
FF	Brownstone
H9	Cordovan
Q8	Navy Blue
SA	Charcoal

PAINT REDUCTION EQUIVALENT CHART

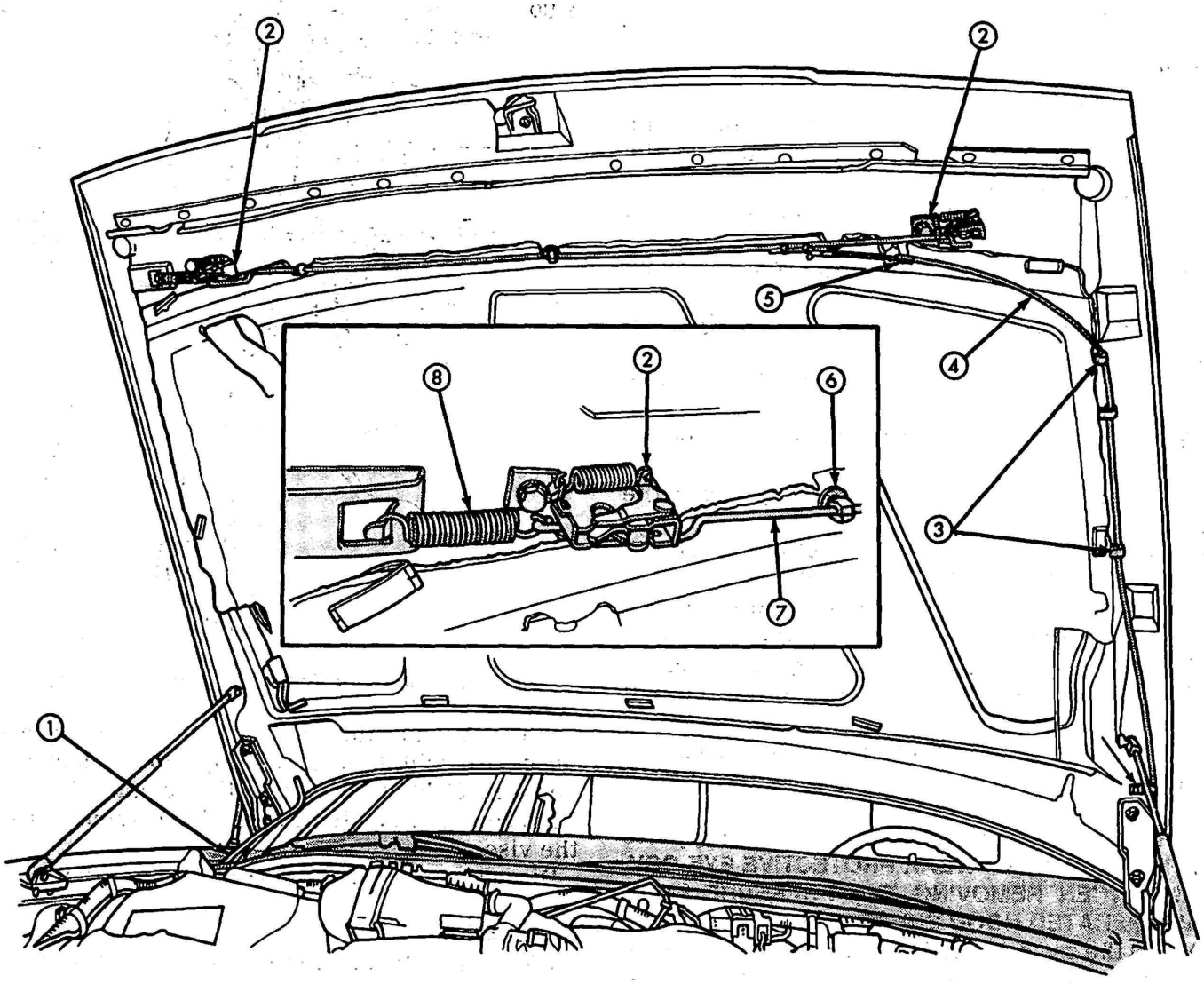
Percent	Parts by Volume		Volume Measure	
	Paint	Reducer or Thinner	Paint	Reducer or Thinner
12-1/2%	8	1	8 oz.	1 oz.
25%	4	1	8 oz.	2 oz.
33-1/3%	3	1	8 oz.	2-3/5 oz.
40%	5	2	8 oz.	3-1/5 oz.
50%	2	1	8 oz.	4 oz.
75%	4	3	8 oz.	6 oz.
100%	1	1	8 oz.	8 oz.
125%	4	5	8 oz.	10 oz.
150%	2	3	8 oz.	12 oz.
200%	1	2	8 oz.	16 oz.
12-1/2%	8	1	16 oz.	2 oz.
25%	4	1	16 oz.	4 oz.
33-1/3%	3	1	16 oz.	5-1/3 oz.
40%	5	2	16 oz.	6-2/5 oz.
50%	2	1	16 oz.	8 oz.
75%	4	3	16 oz.	12 oz.
100%	1	1	16 oz.	16 oz.
125%	4	5	16 oz.	20 oz.
150%	2	3	16 oz.	24 oz.
200%	1	2	16 oz.	32 oz.
12-1/2%	8	1	32 oz.	4 oz.
25%	4	1	32 oz.	8 oz.
33-1/3%	3	1	32 oz.	10-3/5 oz.
40%	5	2	32 oz.	12-4/5 oz.
50%	2	1	32 oz.	16 oz.
75%	4	3	32 oz.	24 oz.
100%	1	1	32 oz.	32 oz.
125%	4	5	32 oz.	40 oz.
150%	2	3	32 oz.	48 oz.
200%	1	2	32 oz.	64 oz.
12-1/2%	8	1	1 gallon	1 pint
25%	4	1	1 gallon	1 quart
33-1/3%	3	1	1 gallon	1-1/3 quarts
40%	5	2	1 gallon	3 pints
50%	2	1	1 gallon	2 quarts
75%	4	3	1 gallon	3 quarts
100%	1	1	1 gallon	4 quarts
125%	4	5	1 gallon	5 quarts
150%	2	3	1 gallon	6 quarts
200%	1	2	1 gallon	8 quarts

NOTE: For paint products—70-85°F @ 35-65% humidity.

SHEET METAL

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① ELECTRICAL CONNECTOR
② LATCH
③ CABLE RETAINER
④ HOOD RELEASE CABLE
⑤ PLASTIC STOP
⑥ ROD GUIDE
⑦ OPERATING ROD
⑧ RETURN SPRING

E8923-263

Fig. 1—Removing/Installing Hood

MANUAL RELEASE OF HOOD LATCHES

In case of cable failure, the hood latches can be opened manually from below the vehicle. On the left side of the vehicle, behind the radiator, insert a 2-1/2 foot long screwdriver up into the hook of the latch operating rod at the end of the cable. Move the rod to the left until the latches are released.

Removal

(1) Open the hood.
(2) Disconnect the electrical connector for the underhood lamp from the body harness at the right front strut tower.
(3) Pull the wire and grommet out of the dash panel.
(4) Disconnect the spring clip from the hood hinge.
(5) Remove screw and cable end retainer attaching cable to hood.
(6) Disconnect the hood release cable housing from the plastic stop.
(7) Disconnect the cable from the latch operating rod.
(8) Remove the hood release cable from the retainers.

WARNING: NEVER ATTEMPT TO DISMANTLE OR REPAIR GAS-OPERATED HOOD SUPPORTS!

(9) Remove the hood supports as follows:
- Have a helper support one side of the hood.
- Release the retaining clip (Fig. 2) with a screwdriver and pull the hood supports off of the ball studs.

(10) Remove the hood attaching nuts (Fig. 3).
(11) Remove the hood.

Disposal Procedures for Gas-Operated Supports

WARNING: ALWAYS WEAR PROTECTIVE EYE COVERING WHEN REMOVING THE PRESSURE FROM GAS-OPERATED HOOD SUPPORTS!

When the gas-operated hood supports have been removed from the vehicle, they may be depressurized in the following manner:
- Place the hood support assembly horizontally in the bench vise. Tighten the vise (Fig. 4).
- Place at least four layers of shop towels over the end of the cylinder in the vise.
- Measure 38 mm (1.5 in.) in from the fixed end of the cylinder.
- Carefully drive a sharp punch through the shop towels into the cylinder until the gas begins to escape.
- Hold the shop towels and punch in place until all the gas has escaped. This should take only a few seconds.
- Then, slowly remove the punch. Escaping oil will be absorbed by the shop towels.

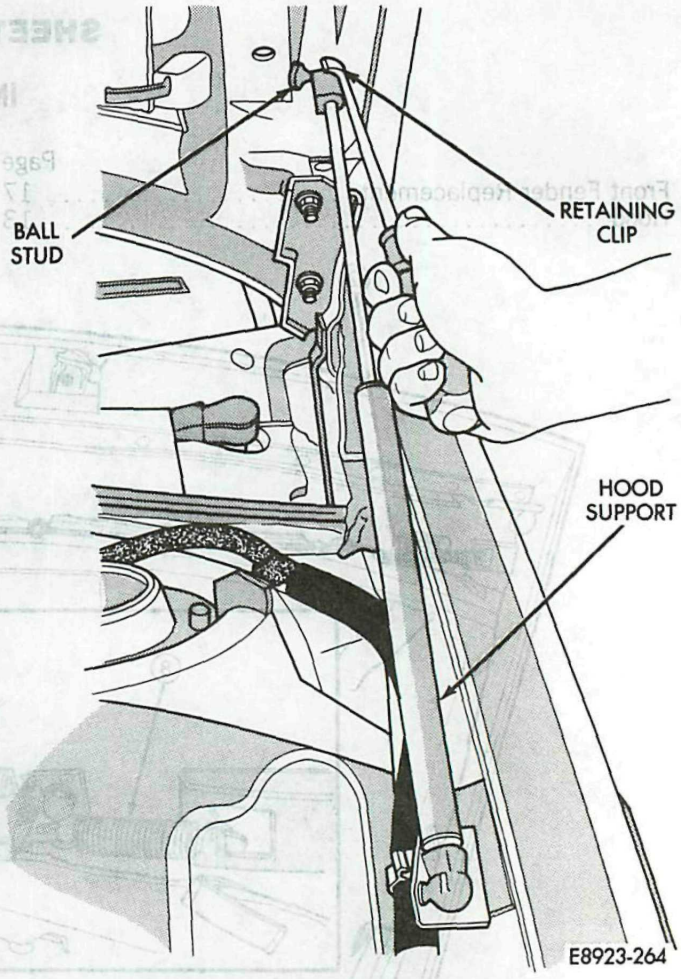


Fig. 2—Removing/Installing Hood Supports

- While still holding the shop towels over the hole, push the bright shaft completely into the black cylinder (Fig. 5). This will purge the remaining oil.
- Loosen the vise. Remove the hood support from the vise.
- Discard the hood support and shop towels.

Installation

(1) Install all serviceable components from old hood and any new parts as necessary.
(2) With the aid of a helper position the hood in place.
(3) Align hood to hinges.
(4) Install the attaching nuts.
(5) Install the hood supports as follows:
- Install the hood supports on the ball studs.
- Install the retainer clips attaching the hood support ball sockets to the ball studs.

(6) Pass the hood release cable through the hood release cable retainers.
(7) Attach the release cable to latch operating rod.
(8) Connect the hood release cable housing to the plastic stra

(9) Attach the cable end to the hood with retainer and screw.

(10) Connect underhood lamp:

• Attach the wire and the spring clip to the hood hinge.

• Pull the wire and grommet through the hole in the dash panel.

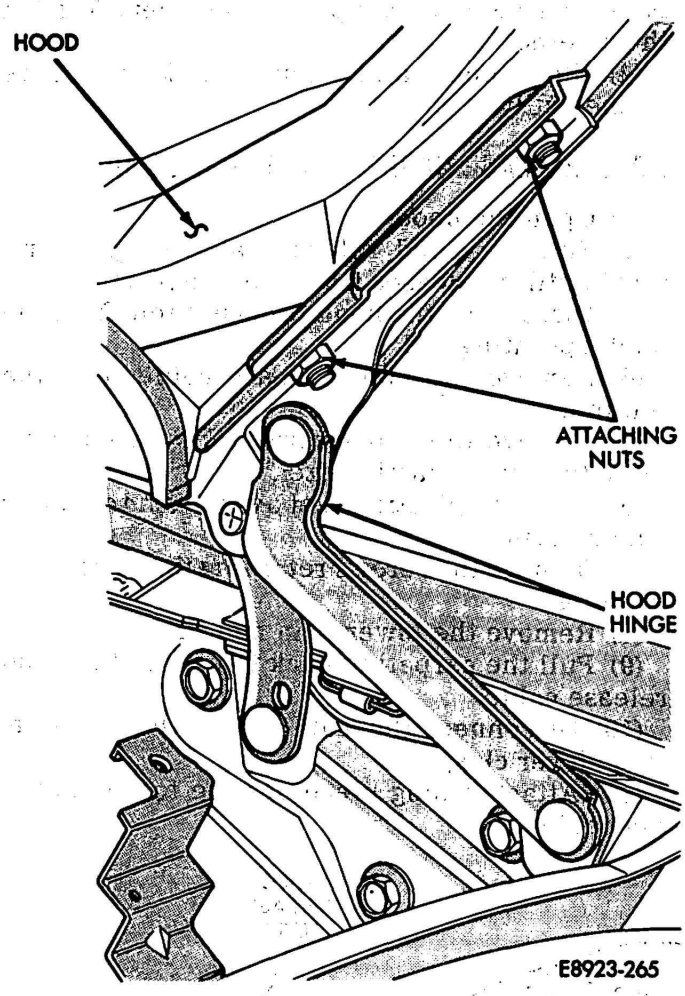


Fig. 3—Hood Hinge Attaching Nuts

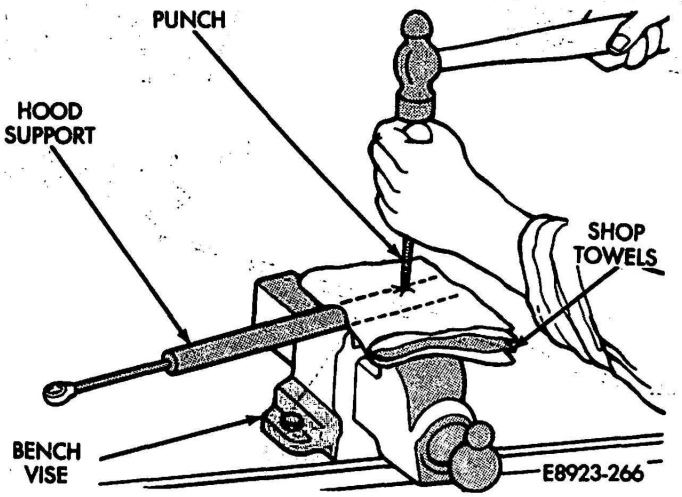


Fig. 4—Hood Support Disposal

• Connect the electrical connector to the body harness.

(11) Align hood, if necessary.

ADJUSTMENTS

The hinge to hood screw holes are slotted to allow fore and aft adjustment.

The hinge to inner fender screw holes are slotted to allow up and down adjustment.

The striker to grille support screw holes are

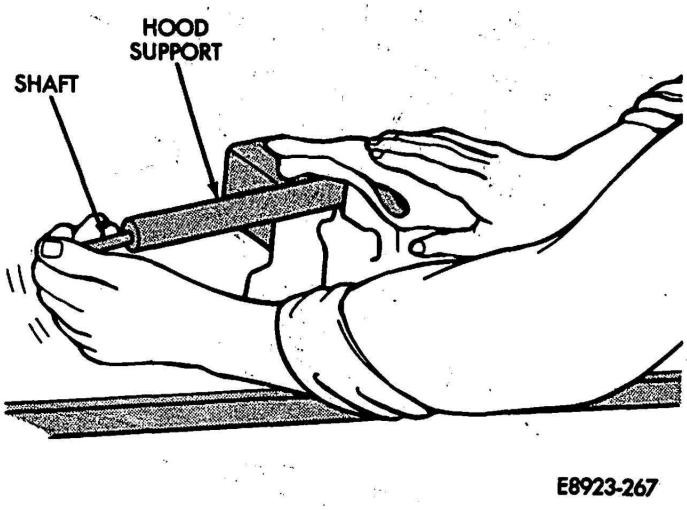


Fig. 5—Purge Hood Support Oil

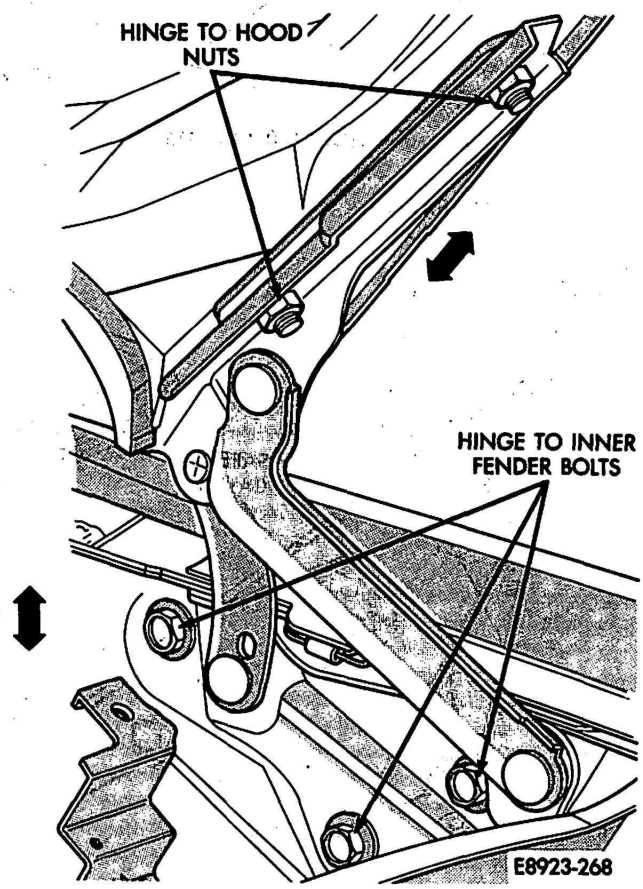


Fig. 6—Hood Hinge Adjustment

slotted to allow left to right adjustment. Also, the base of the striker may be shimmed up or down for proper hood to fender alignment.

ALIGNMENT

(1) To adjust the hood to fender alignment, fore and aft, loosen the nuts (Fig. 6) and move the hood forward or backward, to obtain proper alignment. Tighten the nuts.

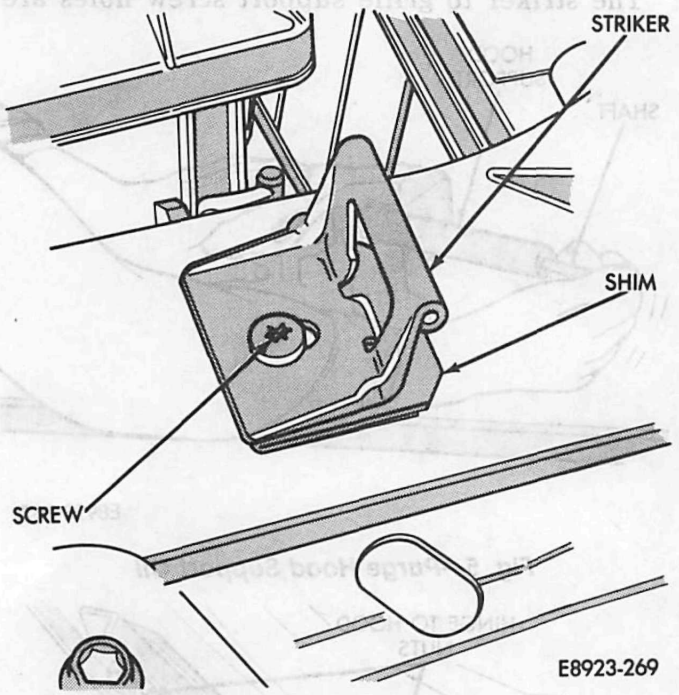


Fig. 7—Striker Adjustment

(2) To adjust the rear edge of hood to fender surface, up and down, loosen the bolts and move the hood hinge up or down, to obtain proper rear alignment. Tighten the bolts.

(3) To adjust the front edge of hood to fender, loosen the striker screws (Fig. 7) and move strikers right or left. Also, add or remove shims to base of striker to obtain proper alignment. Tighten the screws.

(4) Close hood and ensure strikers engage latches fully.

HOOD RELEASE CABLE REMOVAL (Fig. 8)

(1) Open the hood.

(2) Pull the hood release cable (Fig. 9) outward until it releases from the plastic stop.

(3) Disconnect the hood release cable from the latch operating rod.

(4) Remove the hood release cable from the retainers.

(5) Remove the two screws from the hood release/fuel door plastic bezel.

(6) Pivot the plastic bezel away from the lower trim molding.

(7) Remove the screws retaining the lower trim molding.

(8) Remove the lower trim molding.

(9) Pull the carpeting back to expose the hood release cable.

(10) Disconnect the cable from the hood release lever clasp.

(11) Attach a long piece of rope to the end of the cable.

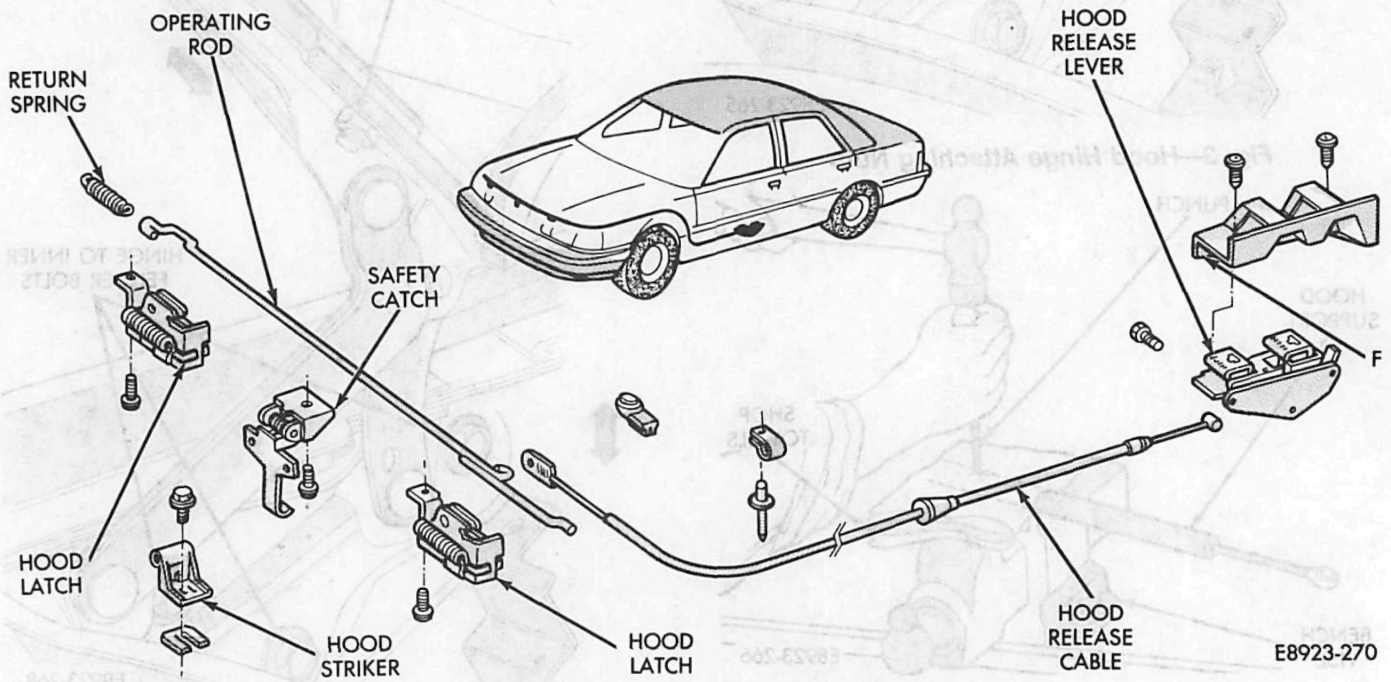


Fig. 8—Hood Latch Components

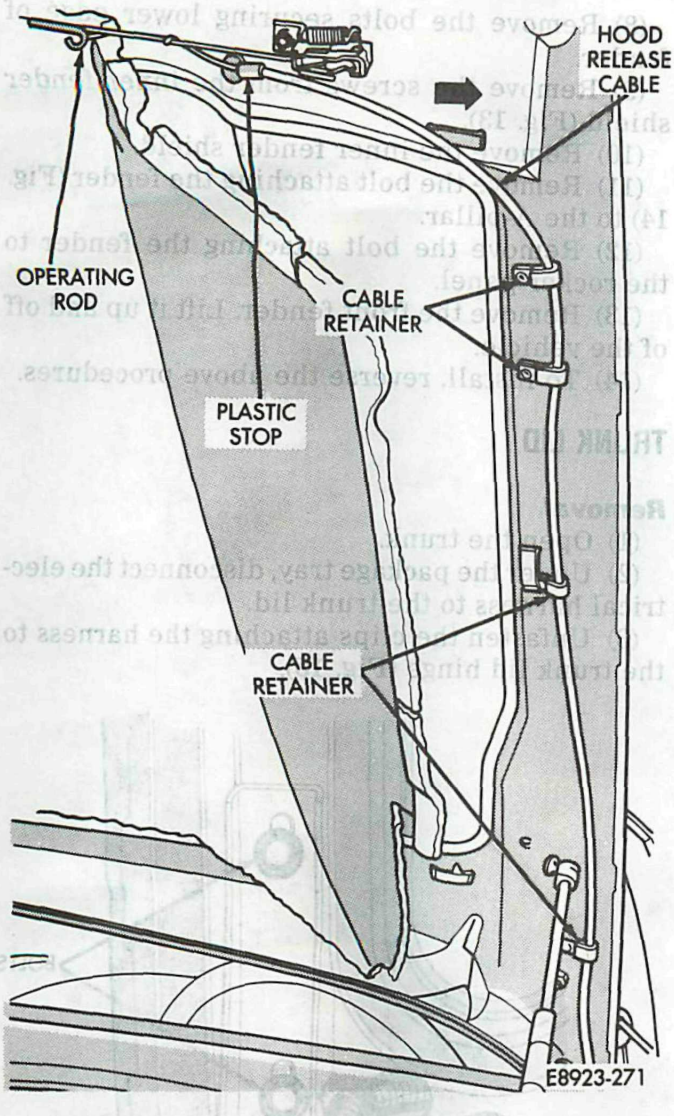


Fig. 9—Hood Release Cable Components

(12) Pull the cable from the vehicle. Do not pull the rope out of the vehicle.
(13) Disconnect rope from cable.

HOOD RELEASE CABLE INSTALLATION

(1) Attach the rope, used during removal, to the hood release lever end of cable.
(2) Pull the rope/cable into the vehicle and disconnect the rope from the end of the cable.
(3) Ensure the cable grommet is seated in the dash panel opening.
(4) Connect the cable to the hood release lever clasp.
(5) Return the carpeting to the proper position.
(6) Install the lower trim panel.
(7) Install the hood releasefuel door plastic bezel.
(8) Pass the hood release cable through the ble retainers.
ch the release cable to ue latch oper-

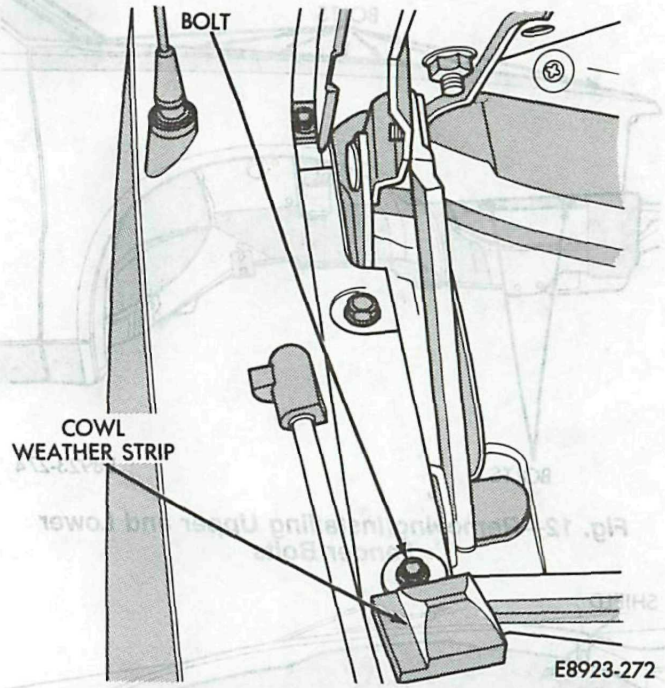


Fig. 10—Removing/Installing Cowl Weatherstrip

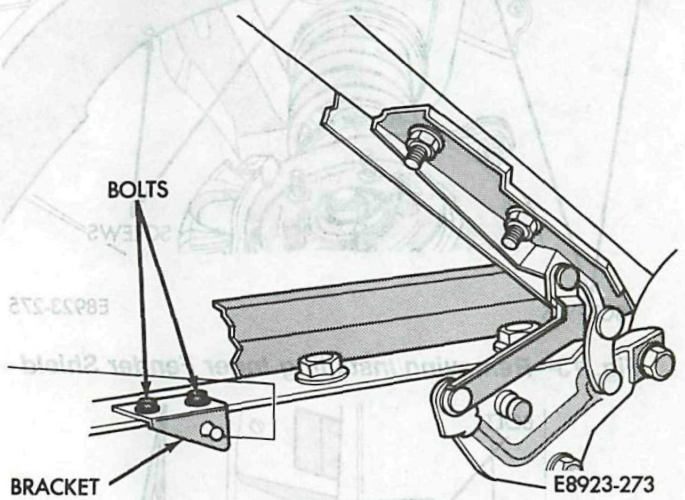


Fig. 11—Removing/Installing Hood Support Bracket

(10) Connect the hood release cable housing to the plastic stop.
(11) Attach the cable end to the hood with a retainer and screw.

FRONT FENDER REPLACEMENT

(1) Remove the hood.
(2) Remove the radio antenna.
(3) Remove the bolt securing the cowl weatherstrip (Fig. 10) to the fender.
(4) Remove the hood support from the fender bracket.
(5) Remove the bolts securing the bracket to the fender (Fig. 11).

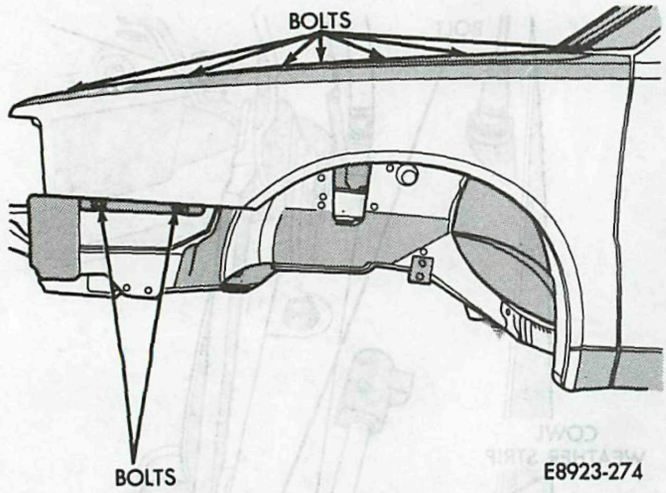


Fig. 12—Removing/Installing Upper and Lower Fender Bolts

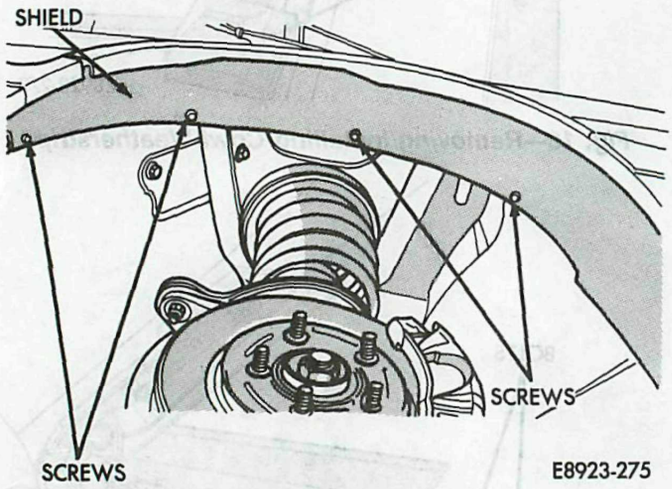


Fig. 13—Removing/Installing Inner Fender Shield

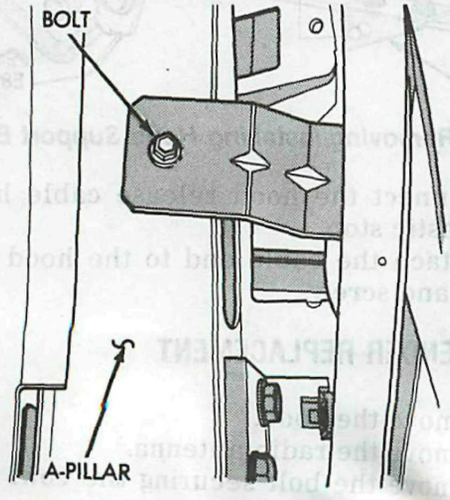


Fig. 14—Removing/Installing Fender to A-pillar Bolt

(6) Remove the bumper fascia to expose the screws.

(7) Remove the bolts securing the top of the fender (Fig. 12).

(8) Remove the bolts securing lower edge of fender.

(9) Remove the screws from the inner fender shield (Fig. 13).

(10) Remove the inner fender shield.

(11) Remove the bolt attaching the fender (Fig. 14) to the A-pillar.

(12) Remove the bolt attaching the fender to the rocker panel.

(13) Remove the front fender. Lift it up and off of the vehicle.

(14) To install, reverse the above procedures.

TRUNK LID

Removal

(1) Open the trunk.

(2) Under the package tray, disconnect the electrical harness to the trunk lid.

(3) Unfasten the clips attaching the harness to the trunk lid hinge (Fig. 15).

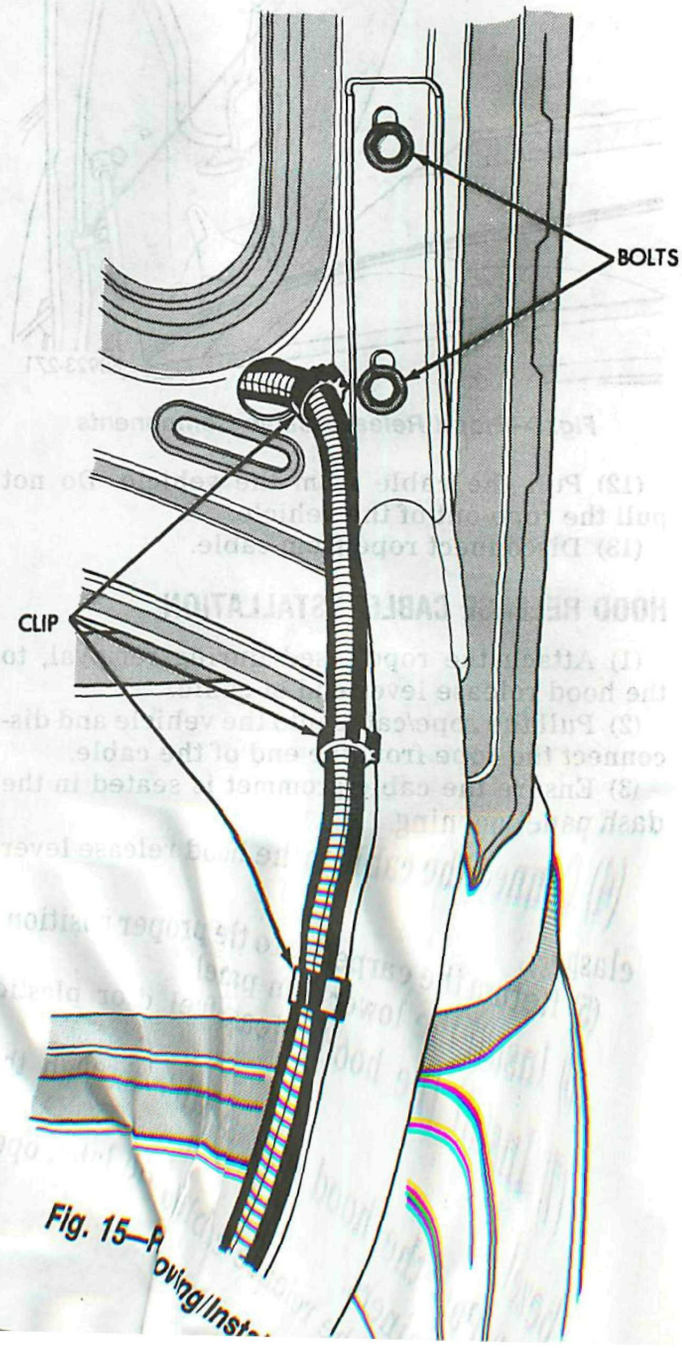


Fig. 15—Removing/Inst...

(4) With the aid of a helper, support both sides of the trunk lid.

(5) Remove the bolts and shims from the hinges. Lift the trunk lid off of the vehicle.

Installation

(1) Install all serviceable components from old trunk lid and any new parts as necessary.

(2) With the aid of a helper position the trunk lid on the hinges.

(3) Install the trunk lid hinge bolts and shims loosely to the trunk lid.

(4) Align trunk lid with trunk opening and tighten the bolts.

(5) Attach clips to the harness.

(6) Connect the electrical harness to the trunk lid.

(7) Close the trunk lid.

Lock Cylinder Removal

(1) Open the trunk lid.

(2) Disconnect the linkage rod from the lock cylinder (Fig. 16).

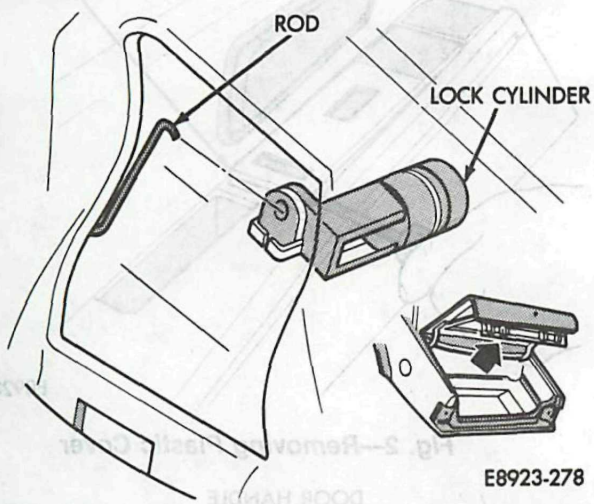


Fig. 16—Removing/Installing Lock Cylinder Linkage

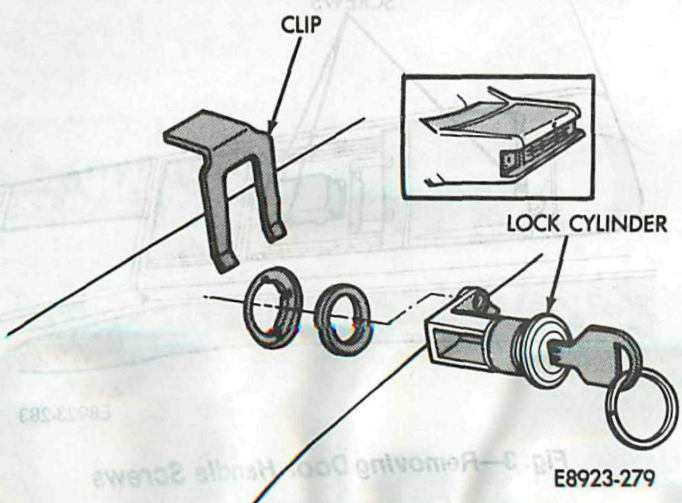


Fig. 17—Removing/Installing Lock Cylinder

(3) Pull the retaining clip off of the lock cylinder (Fig. 17).

(4) Pull the lock cylinder out of the trunk lid.

Lock Cylinder Installation

(1) Place the lock cylinder into the trunk lid.

(2) Install clip into grooves around the head of lock cylinder to secure it to the trunk lid.

(3) Connect the linkage rod in the hole in the lock cylinder.

(4) Close the trunk lid.

Striker Adjustment

The striker provides a secure retention point for the latch and prevents movement of the trunk lid.

Determine proper trunk lid alignment. Open trunk lid. Loosen and move striker to desired position. Tighten striker and check trunk lid for proper position and latch operation.

Hinge Spring Replace

(1) Open the trunk lid.

(2) With the aid of a helper, support the trunk lid.

(3) Pull the spring towards the back of the vehicle to remove it from the bracket (Fig. 18).

(4) Disconnect the spring from the hinge base.

(5) To install, reverse the above procedures.

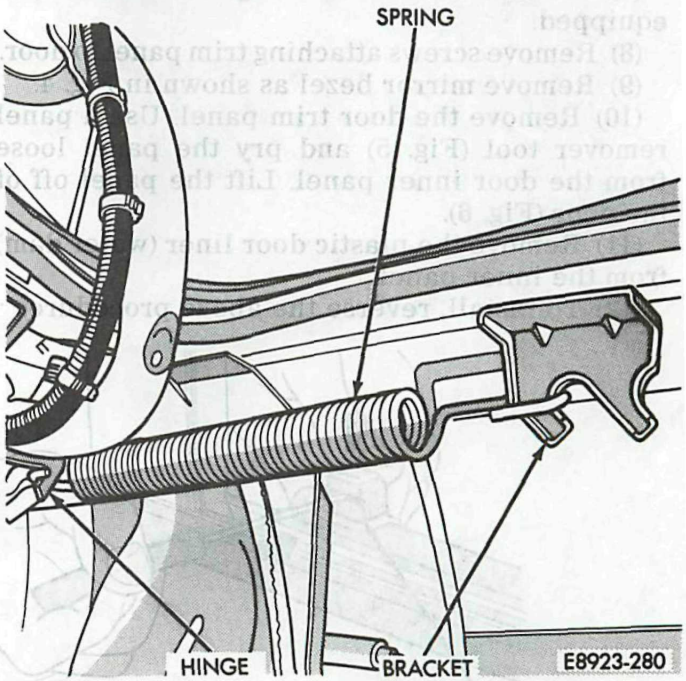


Fig. 18—Removing/Installing Hinge Spring

DOOR SYSTEMS

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Glass System	24
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LATCH AND LOCK SYSTEM

General Information

The door hinge halves are welded to the door and bolted to the body pillar. The door adjustments may be accomplished by moving the hinge half bolted to the body pillar. Also, shims may be used to move the door in or out.

Door Trim Panel Replace

(1) Lower the window.
(2) Disconnect the battery negative cable, if equipped with power options.
(3) Remove the lock button by depressing locking tab and lifting the button (Fig. 1).
(4) Remove the plastic cover by prying up the rear of the cover. Once the rear of the cover is free, move the cover to the rear (Fig. 2).
(5) Remove the screws attaching the inside door handle to the door (Fig. 3).
(6) Lift the door handle/switch up and out of the door.
(7) Remove the window regulator handle, if equipped.
(8) Remove screws attaching trim panel to door.
(9) Remove mirror bezel as shown in Fig. 4.
(10) Remove the door trim panel. Use a panel remover tool (Fig. 5) and pry the panel loose from the door inner panel. Lift the panel off of the door (Fig. 6).
(11) Remove the plastic door liner (water dam) from the inner panel.
(12) To install, reverse the above procedure.

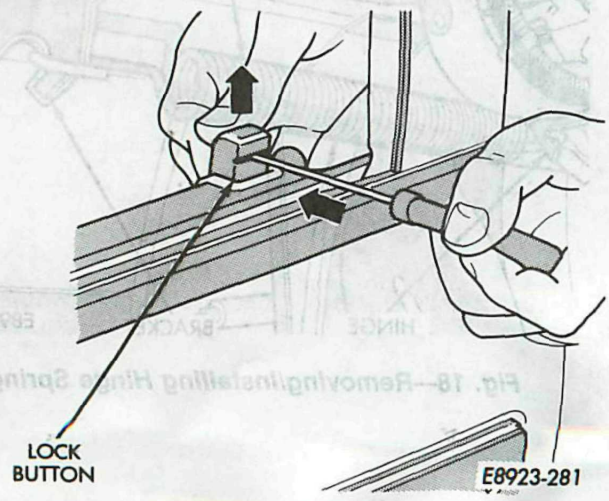


Fig. 1—Removing Lock Button

Front Door

Removal

(1) With door wide open, place a jack (with a block of wood on lifting plate of jack) under door for support.
(2) Remove door interior trim and hardware.
(3) On vehicles with electric wiring in doors, disconnect and remove wiring from door assembly.
(4) Loosen door hinge set screws (Fig. 7).
(5) Remove the bolts attaching the door check assembly to the A-Pillar.
(6) Lift the door straight up and off of the pins.

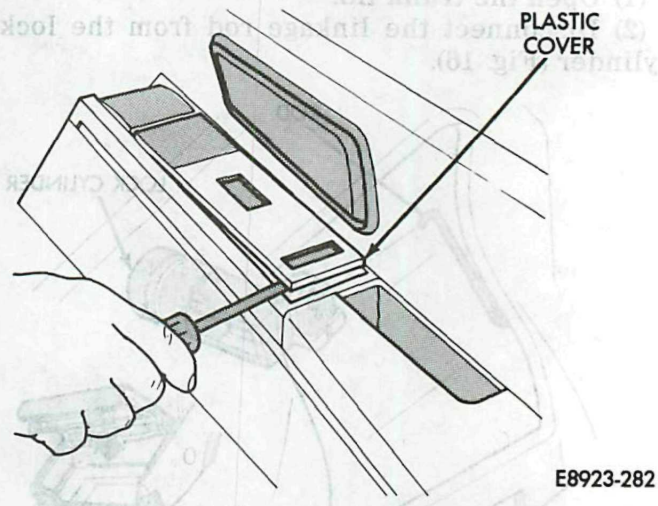


Fig. 2—Removing Plastic Cover

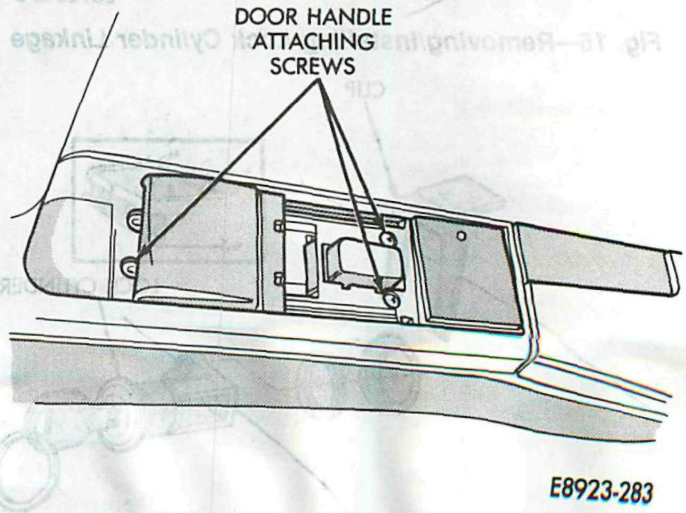


Fig. 3—Removing Door Handle Screws

Installation

(1) With door hardware installed, place door (supported by a padded jack) in position on the hinge pins.

(2) Install the bolts attaching the door check assembly to A-pillar.

(3) Tighten the set screws.

(4) On vehicles with electric wiring in doors, install wiring in doors and attach to components.

(5) Complete door aligning procedure (if required) and install interior trim, handles, and lock button.

Remote Controlled Mirror Replace

(1) Remove mirror bezel as shown in Fig. 4.

(2) Remove the screws attaching the retainer (Fig. 8) to the door. Remove the retainer.

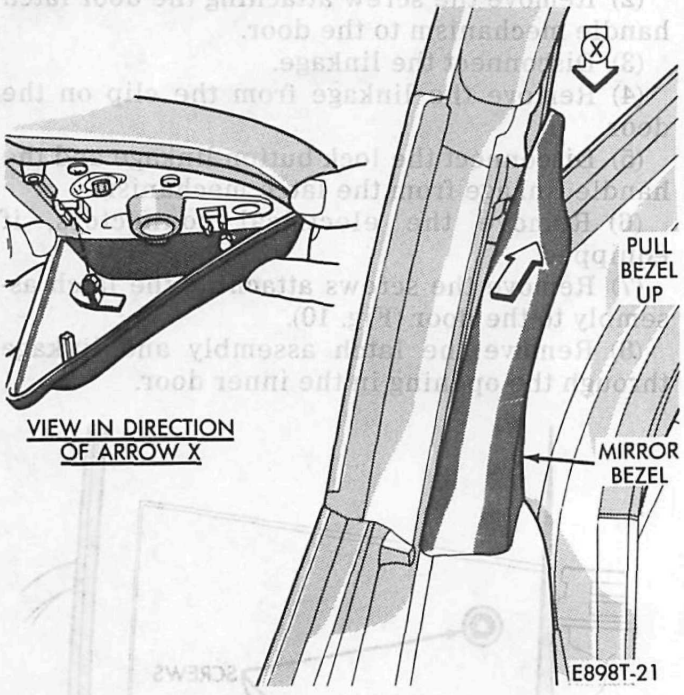


Fig. 4—Removing Mirror Bezel

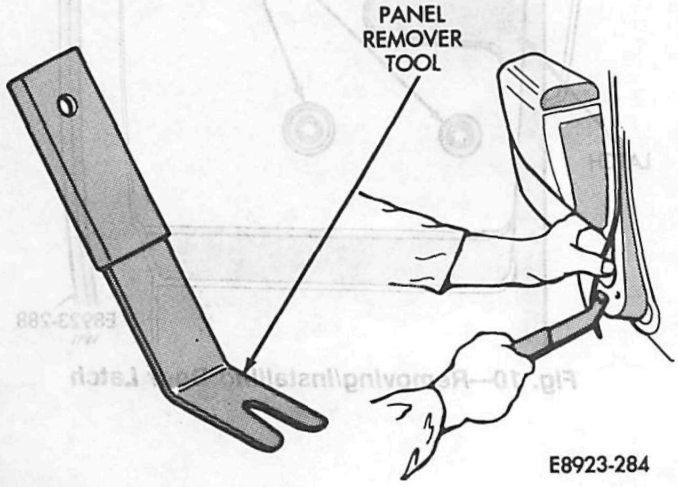


Fig. 5—Removing Trim Panel

(3) Remove the nuts attaching the mirror to the door. Remove the mirror.

(4) To install, reverse the above procedure.

Rear Door

Removal

(1) Open door and place a padded jack under door for support.

(2) Remove door interior trim and hardware.

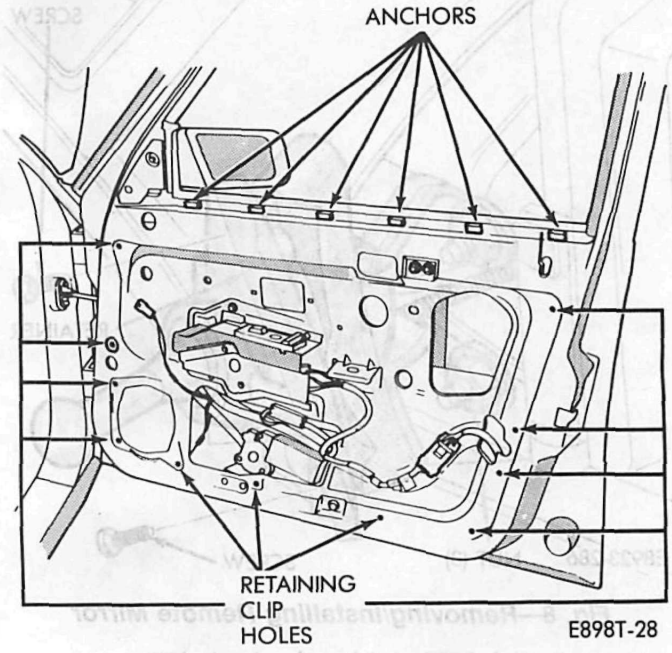


Fig. 6—Trim Panel Attaching Locations

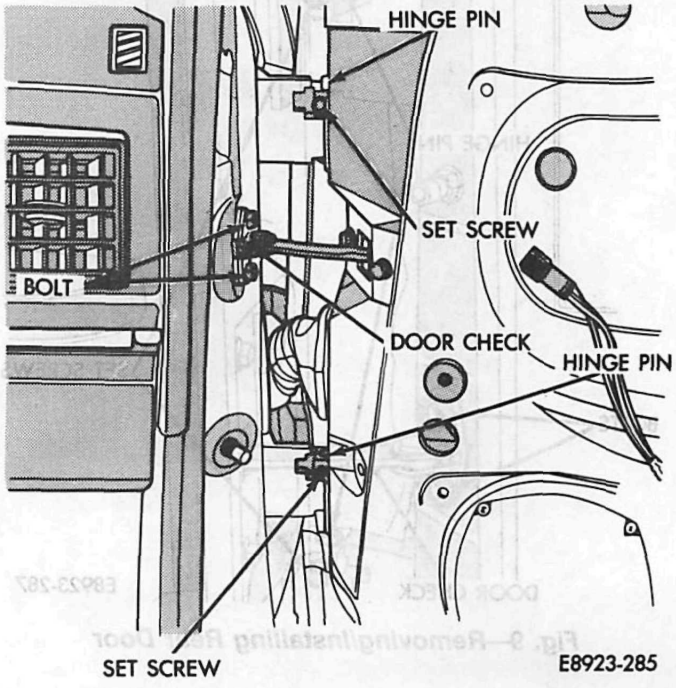


Fig. 7—Removing/Installing Front Door

(3) On vehicles with electric wiring in doors, disconnect wires from accessories and remove wiring from door.

(4) Loosen the hinge set screws (Fig. 9).

(5) Remove the bolts attaching the door check to the B-pillar.

(6) Lift the door straight up and off of the pins.

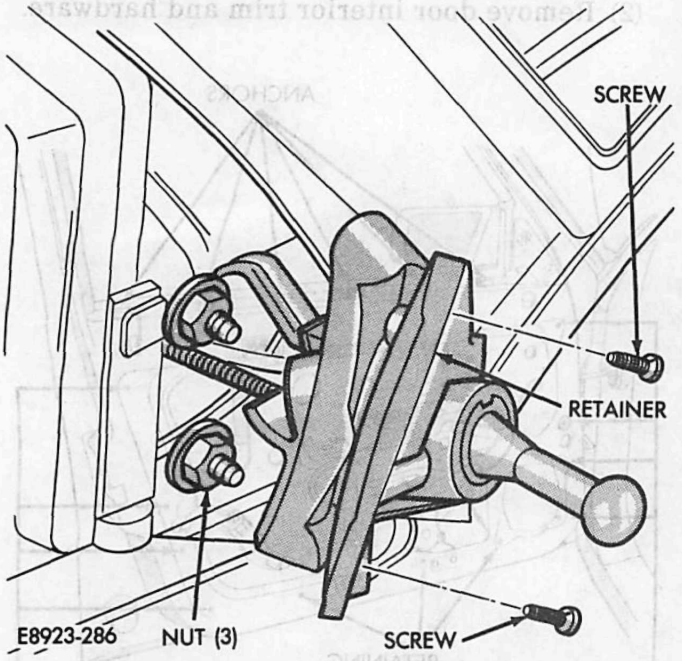


Fig. 8—Removing/Installing Remote Mirror

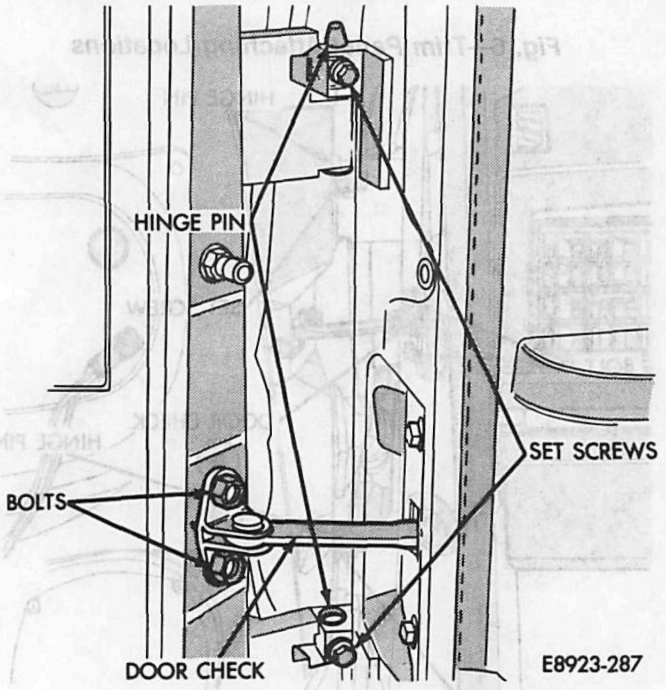


Fig. 9—Removing/Installing Rear Door

Installation

(1) With door hardware installed, place door (supported by padded jack) in position on the hinge pins.

(2) Install the bolts attaching the door check assembly to B-pillar.

(3) Tighten the set screws.

(4) On vehicles with electric wiring in doors, install wiring in doors and attach to components.

(5) Complete door aligning procedure (if required) and install interior trim, handles, and lock button.

Front Door Latch Assembly

Removal

(1) Remove the door trim panel and hardware.

(2) Remove the screw attaching the door latch handle mechanism to the door.

(3) Disconnect the linkage.

(4) Remove the linkage from the clip on the door.

(5) Disconnect the lock button linkage and the handle linkage from the latch mechanism.

(6) Remove the electrical connectors, if equipped.

(7) Remove the screws attaching the latch assembly to the door (Fig. 10).

(8) Remove the latch assembly and linkage through the opening in the inner door.

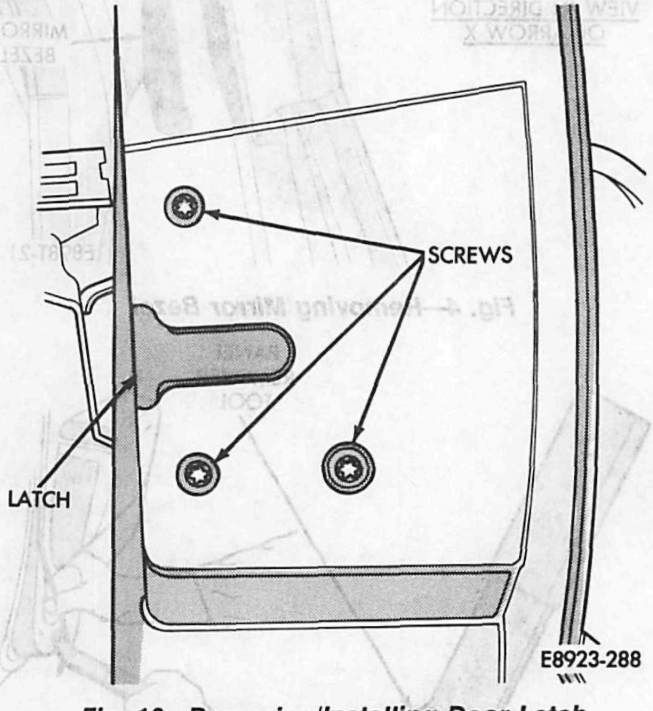


Fig. 10—Removing/Installing Door Latch

Installation

(1) Insert the latch assembly and linkage into the door.

(2) Install the screws attaching the latch assembly to the door.

(3) Connect the linkage from the lock cylinder and the door handle.

(4) Attach the latch linkage to the clip onto the door.

(5) Install the door latch handle to the linkage.

(6) Install the screw attaching the door handle.

(7) Connect the electrical connectors, if so equipped.

(8) Install the door trim panel and hardware.

Front Door Handle

Removal

(1) Remove the door trim panel and hardware.

(2) Remove the screw attaching the handle to the door (Fig. 11).

(3) Disconnect the linkage from the latch.

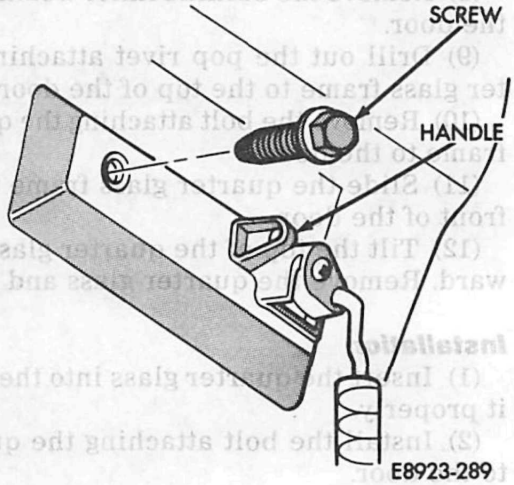


Fig. 11—Removing/Installing Handle Attaching Screw

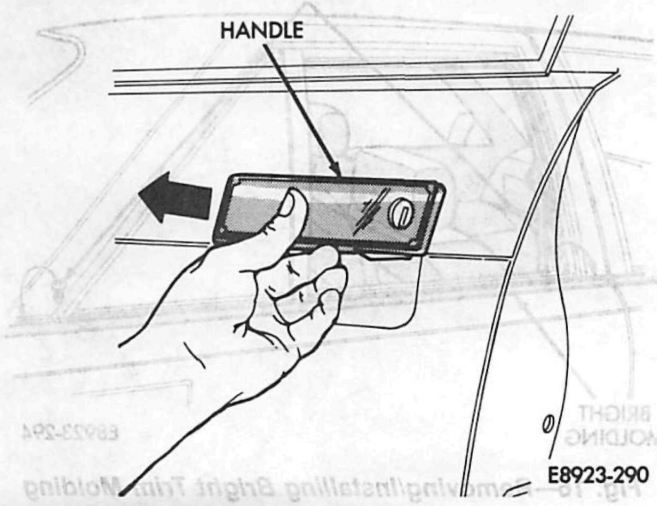


Fig. 12—Sliding Handle Forward

(4) Slide the handle forward to release it from the door as shown in Fig. 12.

(5) Tilt the handle down, as shown in Fig. 13 to remove the linkage.

(6) Pull the clip up, and, off of the handle (Fig. 14). This will release the lock cylinder from the handle.

(7) Remove the handle.

(8) To install, reverse the above procedure.

Weatherstrips

Remove all old weatherstrip particles and cement before applying new weatherstrips. Avoid puckering or stretching of weatherstrip.

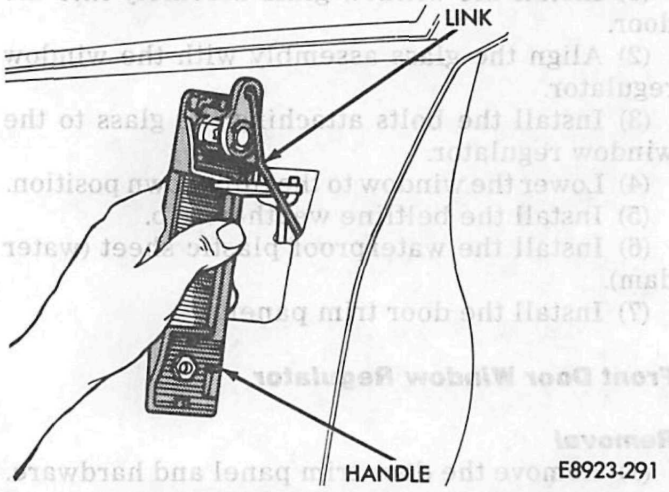


Fig. 13—Removing/Installing Handle Linkage

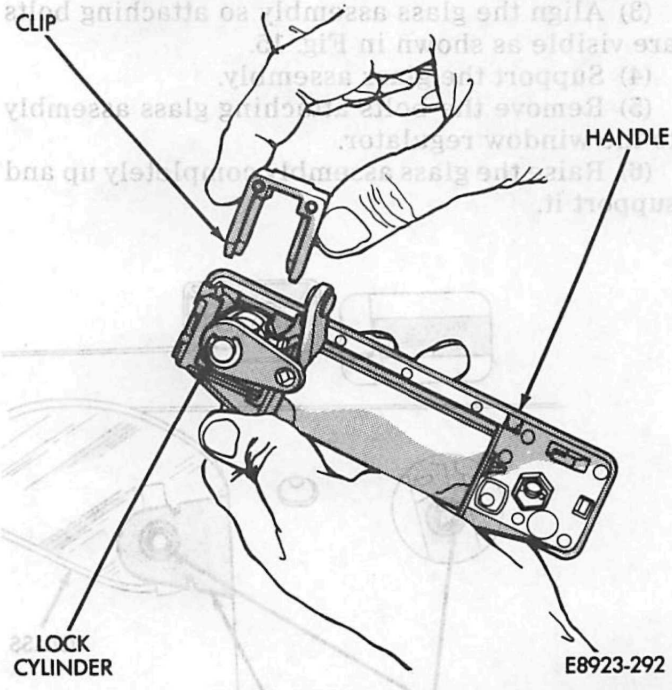


Fig. 14—Removing/Installing Lock Cylinder

GLASS SYSTEM

Front Door Glass

Removal

(1) Remove the door trim panel.
(2) Remove the waterproof plastic liner (water dam).
(3) Remove the beltline weatherstrip.
(4) Remove the bolts attaching the glass to the window regulator (Fig. 15).
(5) Remove the glass from the door.

Installation

(1) Install the window glass assembly into the door.
(2) Align the glass assembly with the window regulator.
(3) Install the bolts attaching the glass to the window regulator.
(4) Lower the window to the fully-down position.
(5) Install the beltline weatherstrip.
(6) Install the waterproof plastic sheet (water dam).
(7) Install the door trim panel.

Front Door Window Regulator

Removal

(1) Remove the door trim panel and hardware.
(2) Remove the waterproof plastic liner (water dam).
(3) Align the glass assembly so attaching bolts are visible as shown in Fig. 15.
(4) Support the glass assembly.
(5) Remove the bolts attaching glass assembly to the window regulator.
(6) Raise the glass assembly completely up and support it.
(7) Remove nuts attaching regulator to inner door panel.
(8) Remove screws attaching regulator gear to inner door panel.
(9) Disengage tube from retainer clip.
(10) Remove regulator assembly from door.
(11) To install, reverse the above procedure.

Stationary Quarter Glass

Removal

(1) Remove the door trim panel and hardware.
(2) Remove the two screws from inside of door, attaching the exterior trim molding (Fig. 16).
(3) Remove the bright trim molding.
(4) Align the glass assembly so attaching bolts are visible as shown in Fig. 17.
(5) Support glass assembly.
(6) Remove the bolts attaching glass assembly to the window regulator.
(7) Lower the window, by hand to the bottom of the door.
(8) Remove the beltline inner weatherstrip from the door.
(9) Drill out the pop rivet attaching the quarter glass frame to the top of the door.
(10) Remove the bolt attaching the quarter glass frame to the door.
(11) Slide the quarter glass frame towards the front of the door.
(12) Tilt the top of the quarter glass frame forward. Remove the quarter glass and frame.

Installation

(1) Insert the quarter glass into the door. Align it properly.
(2) Install the bolt attaching the quarter glass to the door.

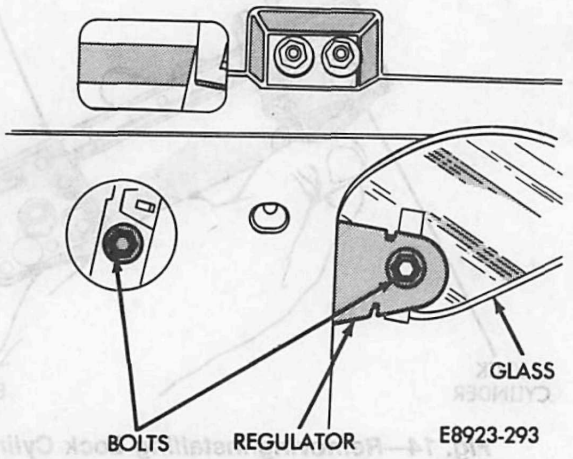


Fig. 15—Removing/Installing Door Glass

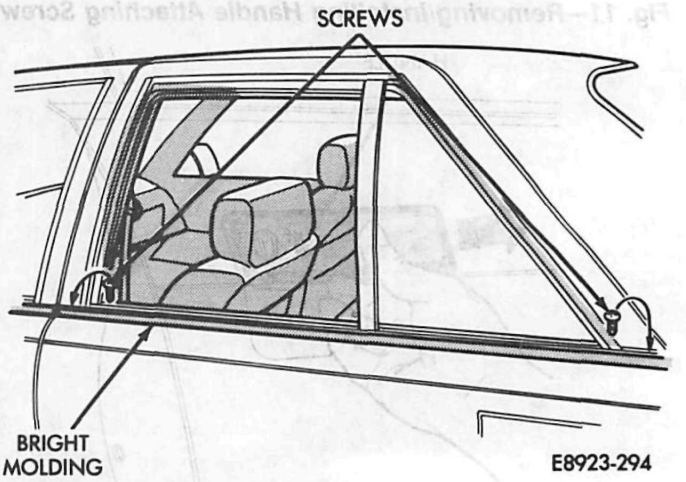


Fig. 16—Removing/Installing Bright Trim Molding

(3) Insert pop rivet attaching the quarter glass and frame to the top of the door.
(4) Align the glass assembly with the regulator.
(5) Install the bolts attaching glass assembly to the window regulator.
(6) Install the beltline inner weatherstrip.
(7) Position the bright trim window molding in place.
(8) Secure with the two attaching screws.
(9) Install the trim panel.

Rear Door Glass

Removal

(1) Remove the door trim panel and hardware.
(2) Remove the two screws from inside of door, attaching the exterior trim molding.
(3) Remove the bright trim molding.
(4) Align glass assembly so attaching bolts are visible as shown in Fig. 17.
(5) Support glass assembly.
(6) Remove the bolts attaching glass assembly to the window regulator.
(7) Lower the window, by hand to the bottom of the door.
(8) Remove the beltline inner weatherstrip from the door.
(9) Remove the glass assembly from the door.
(10) To install, reverse the above procedure.

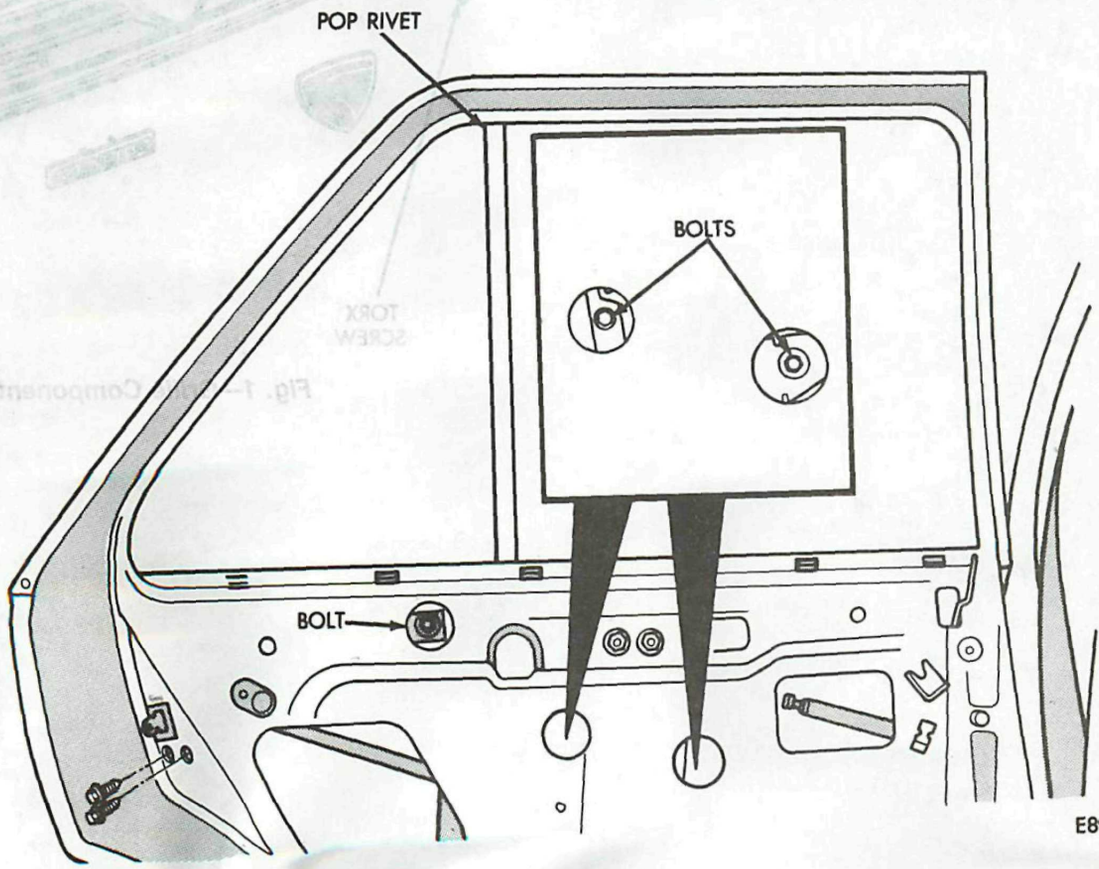


Fig. 17—*Removing/Installing Rear Door Glass*

EXTERIOR TRIM

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GRILLE

Removal

(1) Open the hood.

(2) Remove the hex-head screw and shims (if equipped) attaching the top of the grille to the radiator support (Fig. 1).

(3) Remove the four torx-head screws attaching the grille to the headlamp assemblies.

(4) Remove the grille.

(5) To install, reverse the above procedures.

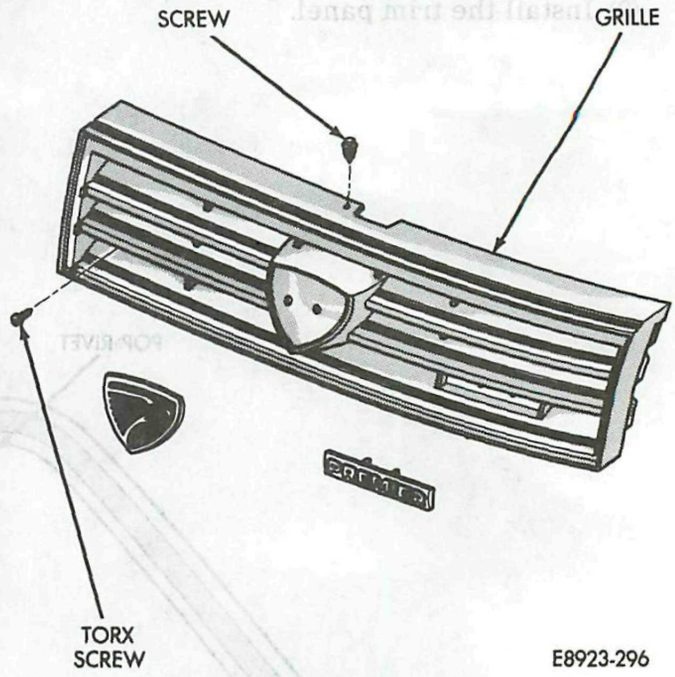


Fig. 1—Grille Components

BUMPERS

Front Bumper Fascia (Fig. 2)

Removal

(1) Remove the grille assembly.
(2) Remove the license plate and holder, if equipped.
(3) Through the grille opening, remove the two hexhead screws attaching the top of the fascia to the bumper bar.
(4) Remove the three plastic drive rivets attaching the bottom of the fascia to the bumper bar.
(5) With the aid of a helper, carefully slide the fascia off of the sliders and bumper bar.
(6) To install, reverse the above procedure.

Front Bumper Fascia Molding (Fig. 2)

Removal

(1) Remove the front bumper fascia.
(2) Remove the eleven nuts attaching the three piece molding to the top of the fascia.
(3) Remove the three piece molding.
(4) To install, reverse the above procedure.

Front Bumper Bar (Fig. 2)

Removal

(1) Remove the front bumper fascia.
(2) Remove the bolts attaching the energy absorbers to the bumper bar.
(3) Remove the bumper bar.
(4) To install, reverse the above procedure.

Front Bumper Energy Absorber (Fig. 2)

Removal

(1) Remove the front bumper fascia.
(2) Remove the front bumper bar.
(3) Remove the screws attaching the energy absorber to the body.
(4) Remove the energy absorber.
(5) To install, reverse the above procedure.

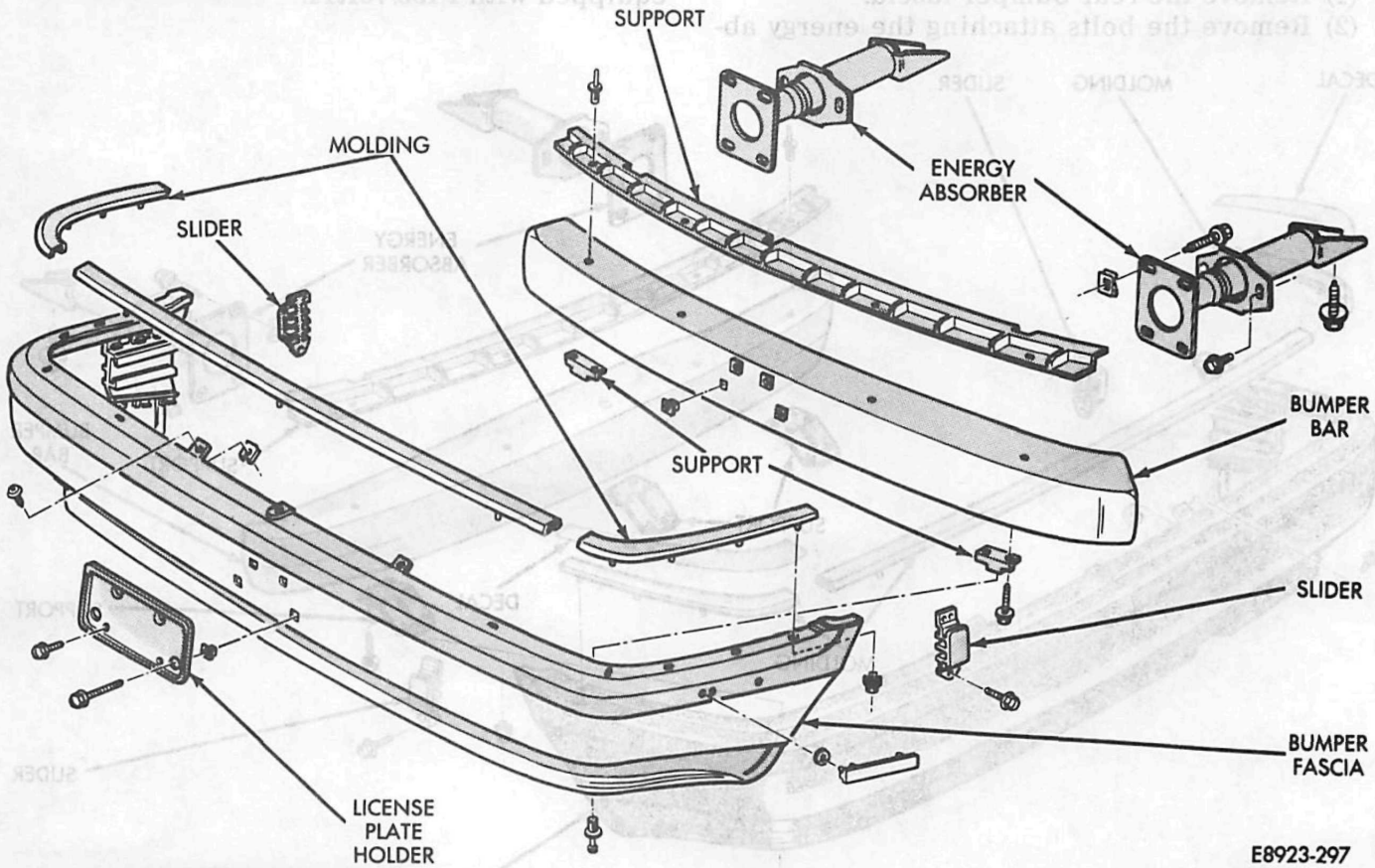


Fig. 2—Front Bumper Components

Rear Bumper Fascia (Fig. 3)

Removal

(1) Remove screws attaching fascia to rear fender wheel lip.
(2) Remove the three plastic drive rivets attaching the bottom of the fascia to the bumper bar.
(3) Remove the two hex-head screws attaching the top of the fascia to the bumper bar.
(4) With the aid of a helper, carefully slide the fascia off of the sliders and bumper bar.
(5) To install, reverse the above procedure.

Rear Bumper Fascia Molding (Fig. 3)

Removal

(1) Remove the rear bumper fascia.
(2) Remove the eleven nuts attaching the three piece molding to the top of the fascia.
(3) Remove the three piece molding.
(4) To install, reverse the above procedure.

Rear Bumper Bar (Fig. 3)

Removal

(1) Remove the rear bumper fascia.
(2) Remove the bolts attaching the energy absorber to the bumper bar.
(3) Remove the bumper bar.
(4) To install, reverse the above procedure.

Rear Bumper Energy Absorber (Fig. 3)

Removal

(1) Remove the rear bumper fascia.
(2) Remove the rear bumper bar.
(3) Remove the screws attaching the energy absorber to the body.
(4) Remove the energy absorber.
(5) To install, reverse the above procedure.

Bumper Heights

General

In order to comply with state and federal regulations, bumpers must be set at the correct height after service. The bumper heights to ground measuring points are shown in Fig. 4.

All measurements should be taken with 10 gallons of fuel in the tank, tires inflated to 35 PSI, no passengers or luggage. Dimensions shown in Fig. 4 are for a vehicle equipped with P185/75R14 tires. Add 4.5mm to the dimension if vehicle is equipped with P195/70R14.

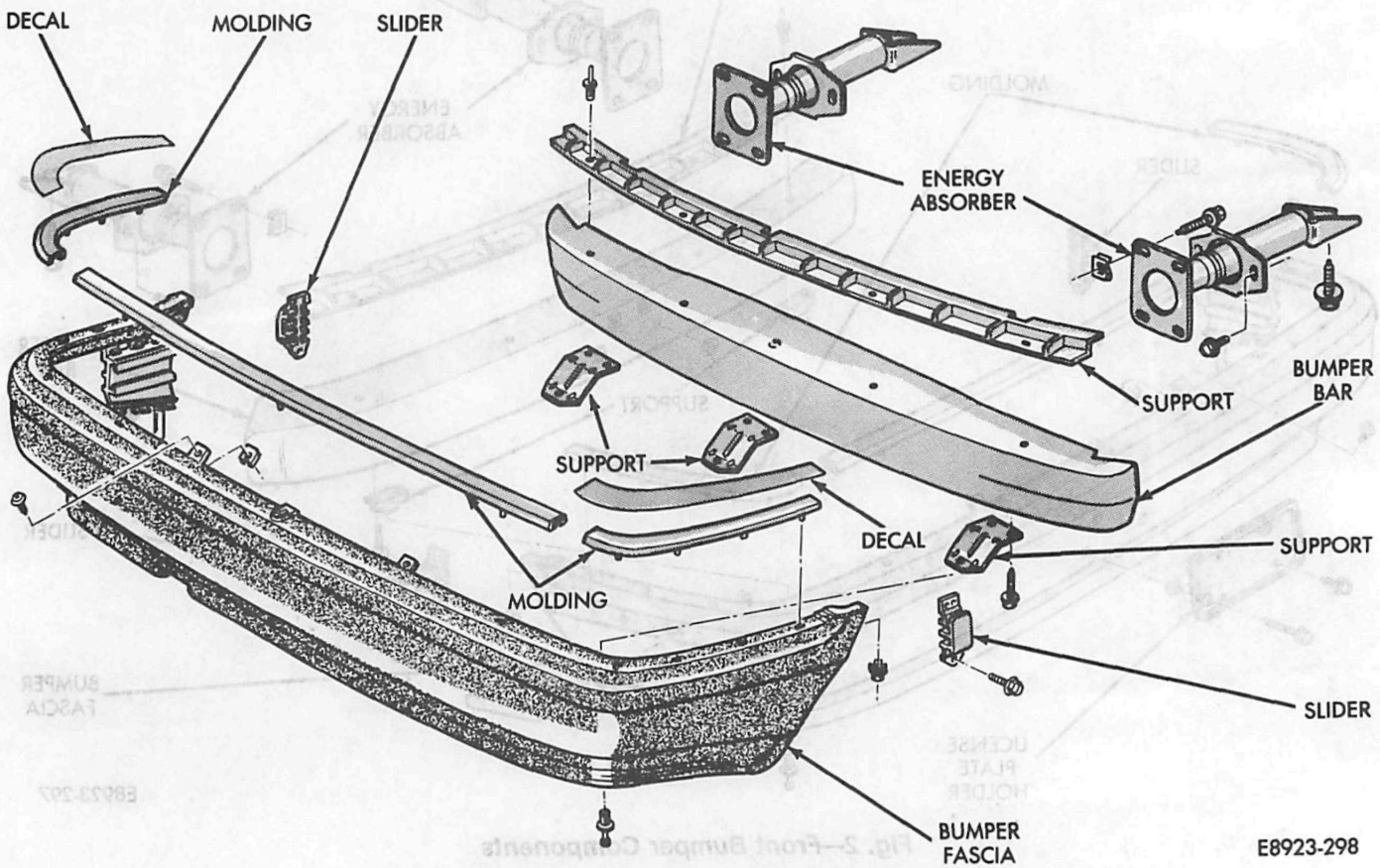


Fig. 3—Rear Bumper Components

Adjustment

Side-to-side adjustment is accomplished by loosening the bolts attaching the energy absorbers to the bumper bar and moving the bumper bar to the proper position.

Vertical adjustment is accomplished by loosening the screws attaching the energy absorbers to the body and moving the bumper bar to the proper position.

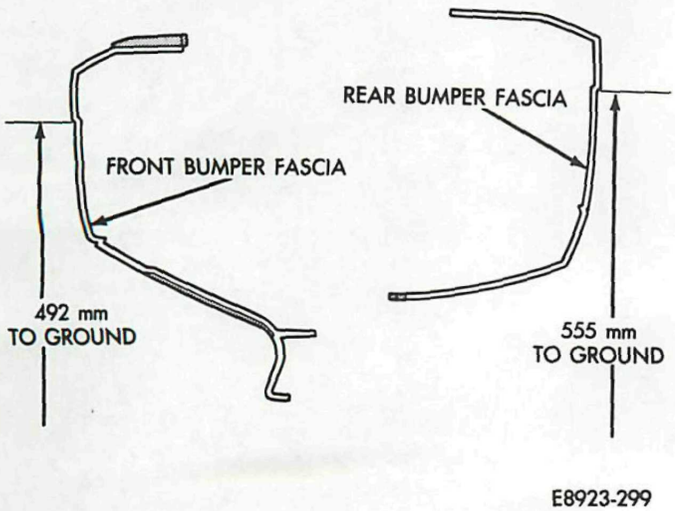


Fig. 4—Bumper Heights

FUEL FILLER DOOR RELEASE CABLE (FIG. 5)

Removal

(1) Disconnect the battery negative cable.
(2) Open the trunk lid.
(3) Remove the carpet from the right side of the trunk.
(4) Open fuel filler door.
(5) Drill out the three pop rivets attaching the fuel filler neck shroud to the body.
(6) Remove the shroud.
(7) Remove the nut attaching the cable assembly to the body.
(8) Pull the cable into the trunk.
(9) Disconnect the cable from clips.
(10) Remove the driver's seat.
(11) Remove the rear seat cushion and back.
(12) Remove the screws attaching the hood release/fuel door plastic bezel.
(13) Pivot the plastic bezel away from the lower trim molding.
(14) Remove the screws attaching the lower trim molding.
(15) Remove the lower trim molding.
(16) Disconnect the cable from the fuel filler door release lever.
(17) Remove tape attaching cable to the floor pan.
(18) Remove cable assembly from vehicle.
(19) To install, reverse the above procedure.

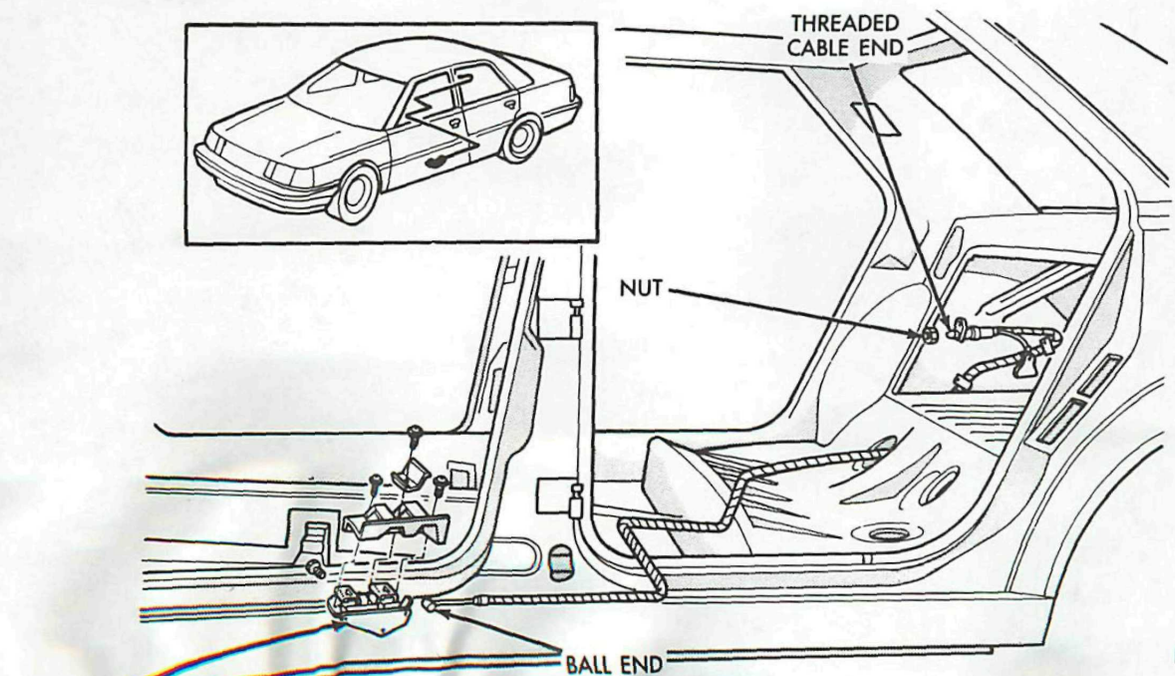


Fig. 5—Removing/Installing Fuel Filler Door Release Cable

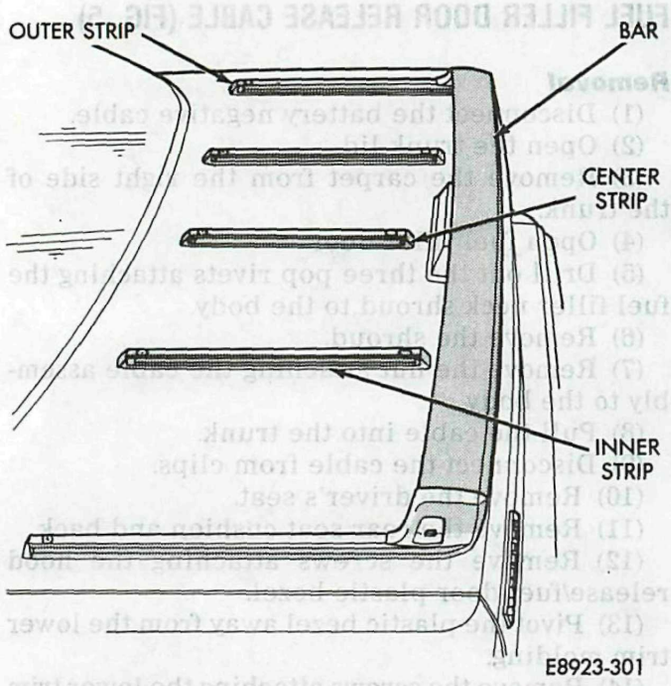


Fig. 6—Removing/Installing Luggage Rack

LUGGAGE RACK (FIG. 6)

Removal

(1) Remove the four screws attaching the outer strips and bar to the trunk lid.

(2) Remove the outer strips and bar.

(3) Remove the six screws attaching the two inner strips and center strip to the trunk lid.

(4) Remove the inner and center strips.

(5) To install, reverse the above procedure.

INTERIOR TRIM

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REAR VIEW MIRROR (Fig. 1)

Replacement

(1) Loosen the set screw and slide the mirror up and off the button.

(2) Installation is accomplished by sliding the mirror over the button and tightening the set screw. Care should be exercised not to over tighten the screw.

REAR VIEW MIRROR SUPPORT

Installation

(1) Using a wax pencil, locate and mark the mounting position of the support on the outside of the windshield.

(2) If the vinyl pad has remained on the windshield glass, apply "low heat" to it with an electric heat gun until the vinyl softens, then peel the vinyl pad from the glass.

(3) Thoroughly clean the inner surface of the windshield glass in the mounting area of the mirror support using a mild abrasive cleaning powder such as Ajax, Comet, or equivalent, on a clean cloth saturated with alcohol. Then, apply alcohol to a paper towel and wipe off any traces of remaining cleaner.

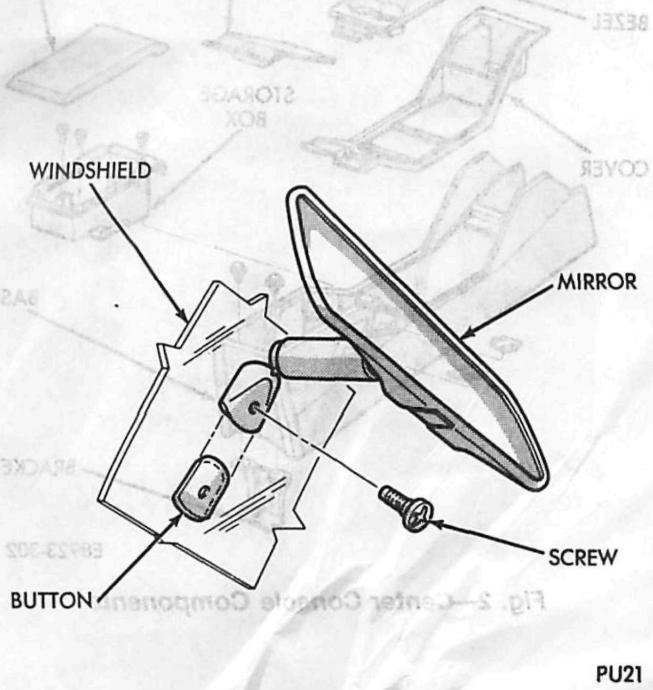


Fig. 1—Removing/Installing Rear View Mirror

(4) Thoroughly sand the windshield mounting surface of the mirror support (the side with least surface area) with a clean piece of fine grit sandpaper and wipe the surface clean with a clean paper towel saturated with alcohol.

(5) Using kit 4054099 or equivalent, crush the vial in the plastic housing of the accelerator. This saturates felt applicator. Remove paper sleeve. Apply a generous amount of Accelerator on the mounting surface of the mirror support.

(6) Allow the Accelerator to dry for five minutes. Do not touch the mounting surface of the support or glass.

(7) Apply a thin film of Accelerator to the inner surface of the windshield in the support mounting area. Allow one minute to dry. Do not touch the surface.

(8) Apply one drop of Adhesive to the center of the windshield mounting surface of the mirror button and, using the bottom of the Adhesive tube, quickly distribute the adhesive evenly over the entire bonding surface of the support.

(9) Position the bottom straight edge of the mirror support on the horizontal line and center it on the vertical line and press it firmly to the glass and apply pressure for about one minute. Proper location is essential as cement sets up very fast.

(10) Allow five minutes for the adhesive to set; then, remove any excess adhesive residue from the windshield in the attachment area using an alcohol-dampened cloth.

(11) Slide the mirror downward onto the support and tighten the screw.

FLOOR COVERING (Carpet and Floor Silencer)

Removal and Installation

To remove the floor covering, it is necessary to remove the front seat assembly, the rear seat cushion, scuff plates, trim panels, center pillar trim covers, and front seat belt anchorage bolts.

The body wiring is fed through the holes in the

floor covering. The front edge of the front floor silencer is positioned fully forward so that it overlaps the lower edge of the dashliner silencer. With air conditioning, the floor covering front edge must be inserted underneath the lower air conditioning housing.

Maintenance

Vacuum carpeting thoroughly.

If carpets are slightly soiled first remove spots with Overspray Remover and then shampoo with Upholstery Cleaner. Mix shampoo 8 to 1 if slightly soiled, stronger if required.

Apply cleaner solution with a natural sponge and agitate suds with a scrub brush.

GARNISH MOLDINGS

When removing a garnish molding that is overlapped by an adjoining molding, loosen the end attaching screw to prevent possible damage to both moldings.

HEADLINING

Removal and Installation

(1) Remove all headliner mounted components such as sun visors, coat hooks, and overhead console.

(2) Remove C-pillar trim panel.

(3) Remove garnish moldings.

(4) Remove headliner from vehicle.

(5) Reverse above procedure for installation.

Maintenance

Fabric or molded board headlining that is dirty, but not deeply stained, may be restored by thoroughly shampooing according to the following directions:

(1) Mix a soap flake solution such as Ivory Flakes or equivalent in warm water and work up to a very rich suds.

(2) Cover the seats with water repellent material to prevent spotting caused by cleaner dropping from the headliner while cleaning.

(3) Sponge suds on the headliner. Start at the left rear corner and clean one section at a time. Work the suds into the fabric with a circular or back and forth motion.

(4) When section looks clean, finish off with the sponge by laying the nap in one direction. (Otherwise after drying, some sections of headliner will look darker or lighter than others). Begin washing next section of headliner by overlapping approximately three inches of washed area to avoid possible streaking.

(5) Wash the sun visors in the same manner as the headliner.

(6) Once the cleaning process is started, continue until the entire headliner is completed. Otherwise stains may appear where the first section washed, has dried.

CENTER CONSOLE

Removal

(1) Remove ash tray by pulling it up and out of ash tray receiver (Fig. 2).

(2) Remove screw holding ash tray receiver.

(3) Disconnect wire from cigar lighter.

(4) Remove two screws holding front of console to bracket.

(5) Remove three screws holding armrest assembly to the console.

(6) Remove the armrest assembly by pulling it up and out of the console.

(7) Remove two screws holding rear of console to bracket.

(8) Reach inside console and push out the seat belt guides.

(9) Remove the console.

(10) To install, reverse the above procedure.

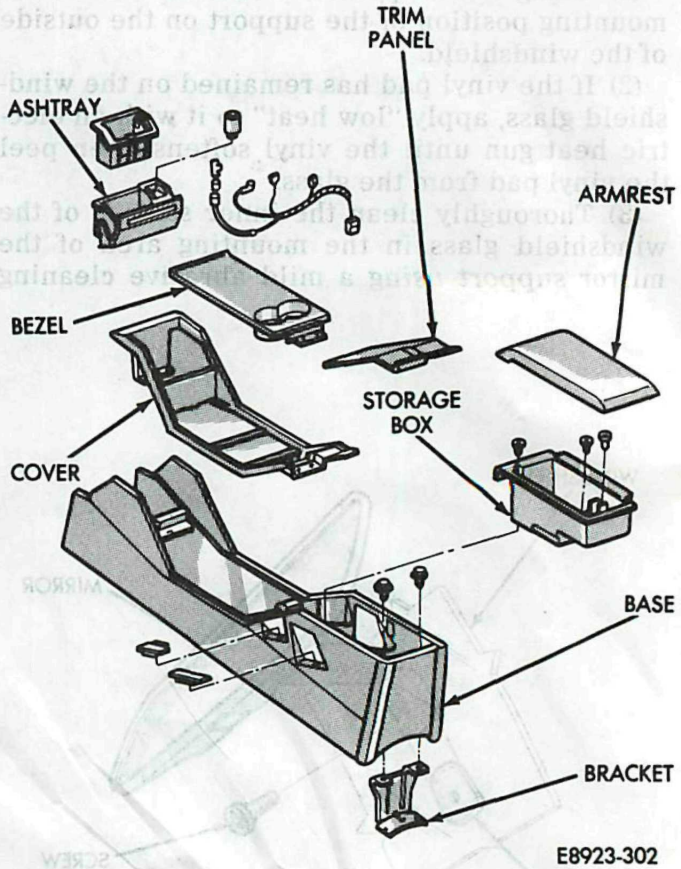


Fig. 2—Center Console Components

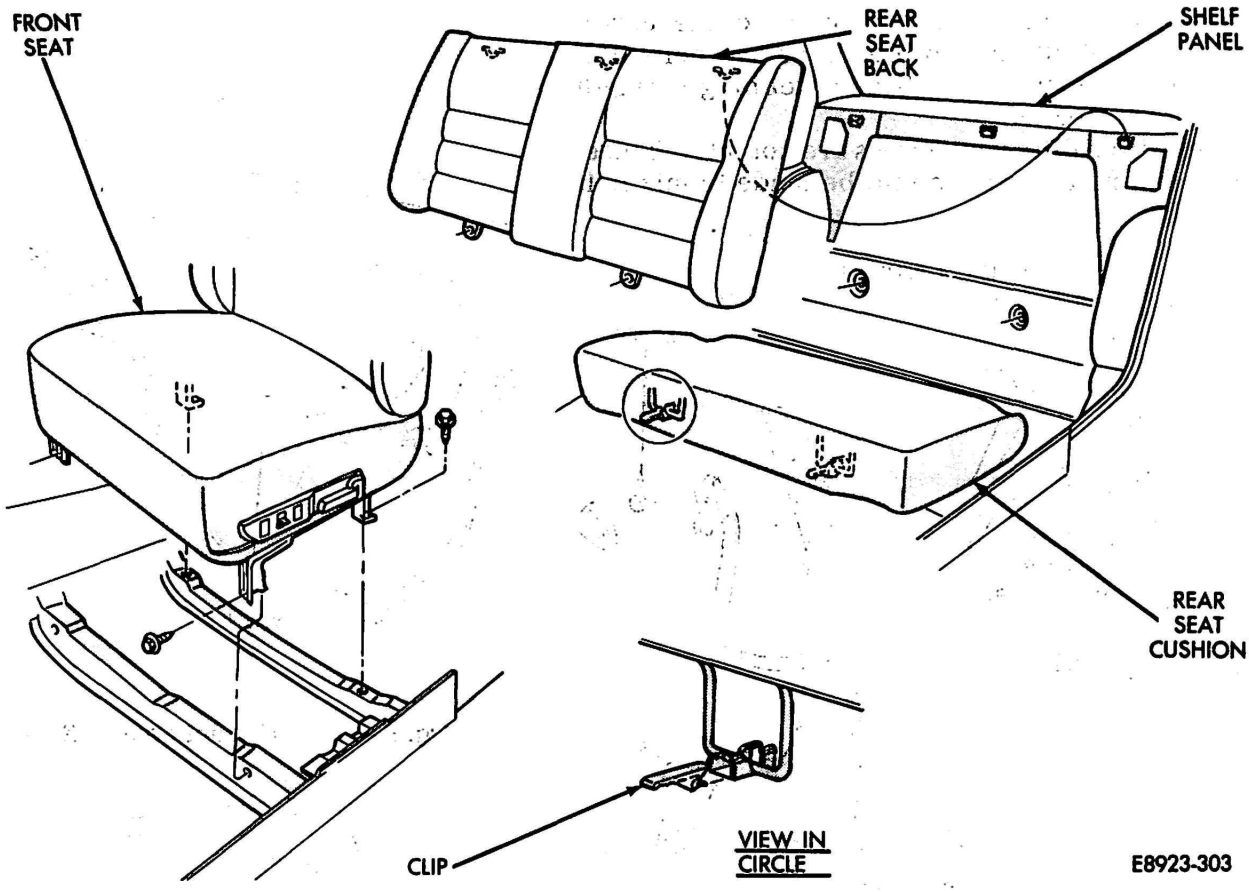


Fig. 3—Front and Rear Seat Components

MANUAL FRONT SEATS (Fig. 3)

Removal

(1) Move the front seat all the way forward and remove the bolts attaching the seat track to the floorpan.

(2) Move the seat all the way rearward and remove the bolts attaching the seat track to the floorpan.

(3) Remove the front seat from the vehicle.

(4) To install, reverse the above procedure.

MANUAL FRONT SEAT TRACK

Removal

(1) Remove the front seat from the vehicle.

(2) Remove nuts attaching seat track to seat frame.

(3) Remove seat track.

(4) To install, reverse the above procedure.

REAR SEAT CUSHION (Fig. 3)

Removal

(1) Remove clips attaching the seat cushion to floorpan brackets.

(2) Lift front of seat cushion freeing legs from floorpan brackets.

(3) Remove seat cushion from vehicle.

(4) To install, reverse the above procedure.

REAR SEAT BACK

Removal

(1) Remove the rear seat cushion.

(2) Remove the bolts attaching the rear seat belts and seat back to the floorpan.

(3) Remove the seat back.

(4) To install, reverse the above procedure.

SEAT BELTS

Seat belts should be worn whenever the vehicle is in motion. The operation and mounting of the belts should not be tampered with at any time. When removal, installation or repair is necessary, refer to (Figs 4 through 6) for proper system location and mounting hardware. A hard pull on the shoulder belt will NOT lock the belt. The retractor has a pendulum weight which locks the shoulder belt during rapid deceleration of the vehicle.

The webbing used in belts may be cleaned with a hydrocarbon dry cleaner and with soap or detergent in water. Avoid getting dry cleaners or water solutions into the buckle mechanism where

they may attack the lubricant or cause corrosion. Do not attempt to bleach or dye belts. Resulting color may rub off and webbing strength could be affected.

Belts from different models are not interchangeable and no attempt should be made to mix belt lengths.

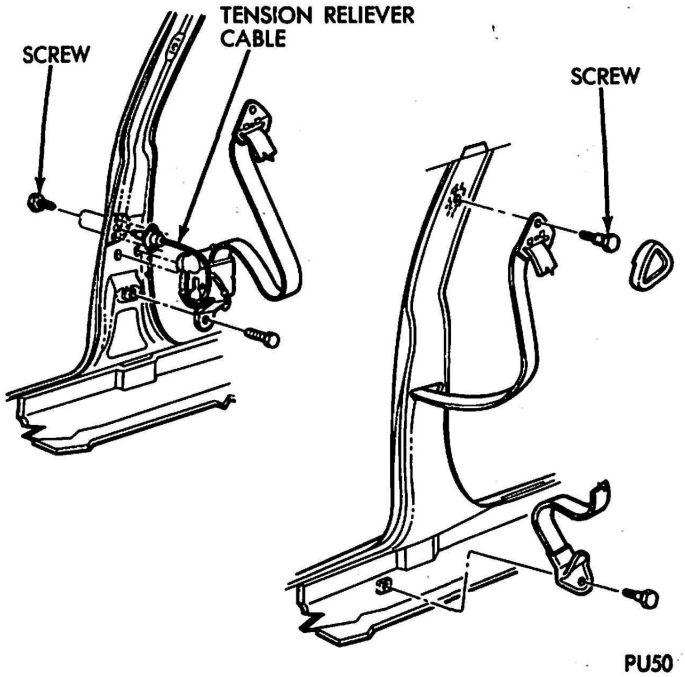


Fig. 4—Outboard Front Seat Belts—Typical

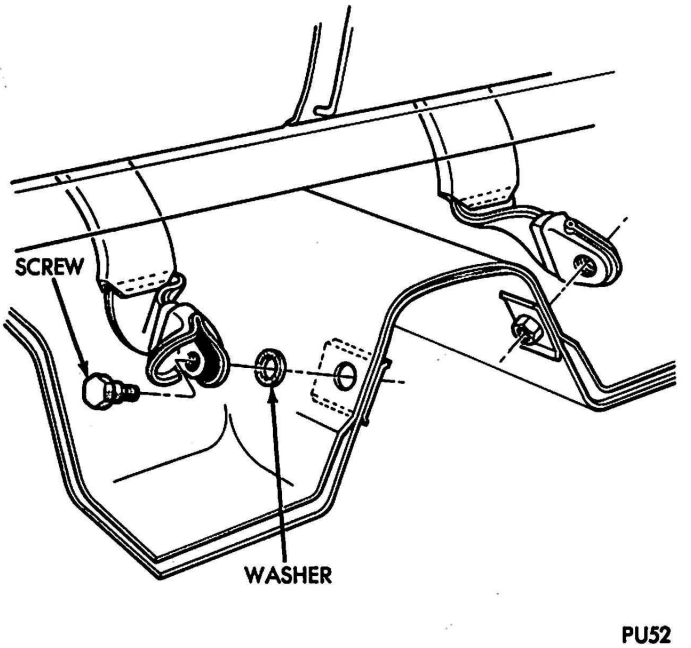


Fig. 5—Inboard Front Seat Belts—Typical

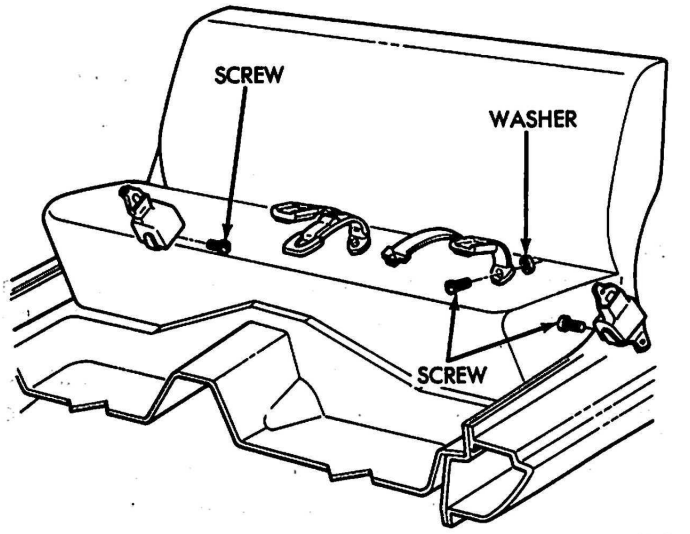


Fig. 6—Rear Seat Belts—Typical

STATIONARY GLASS

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GENERAL INFORMATION

The windshield and rear glass assembly are bonded to the body openings with urethane adhesive to provide greater roof-to-body structural support and improved glass retention and sealing.

WINDSHIELD

Removal

(1) Remove the windshield wiper blade and arm assemblies.
(2) Place protective coverings over the areas adjacent to the glass being replaced.
(3) Remove left and right cowl top grille panels.
(4) Remove the A-pillar weatherseals from the windshield side moldings.
(5) Remove the screws attaching the windshield side molding to the A-pillar. Remove moldings.
(6) Remove interior garnish moldings.
(7) Insert electric hot knife (Miller Tool No. 4386 or equivalent) into the urethane at the upper area of the A-pillar.
(8) Cut downward to the bottom of the windshield, as close as possible to the inside surface of the glass.
(9) Cut the urethane at the top of the windshield from inside the vehicle.
(10) Cut the urethane between the upper windshield molding and the opening from outside the vehicle.
(11) Cut the urethane in the lower corner of the windshield from the outside.
(12) Cut the urethane at the bottom of the windshield with a long blade hot knife.
(13) With the aid of a helper, tip the windshield forward from inside the vehicle and cut the remaining urethane.
(14) Remove the windshield from the vehicle.

Installation (Fig. 1)

(1) Clean the replacement windshield and upper windshield molding.
(2) Cut down the remaining urethane high spots on the fence/flange using a utility knife to provide a level base for the glass installation.
(3) Complete urethane removal is not necessary.
(4) Clean the fence area using naptha or equivalent solvent.
(5) Apply urethane metal primer to the bare metal areas of the windshield fence/flange, allow 18 minutes drying time.
(6) Wipe the bonding surface of the glass using cheesecloth dampened with naptha. Follow immediately with a dry wipe using clean dry cheesecloth.
(7) In a well ventilated area, prime the inside outer periphery of the glass (frit area) with clear glass primer and cheesecloth. Wipe dry using clean dry cheesecloth.
(8) Apply blackout primer, with brush, to entire periphery of glass including edge of glass. Allow 3 minutes drying time.
(9) Install replacement upper glass molding on windshield.
(10) Place glass into the body opening.
(11) Adjust lower support spacers to obtain proper position of glass in opening.
(12) Apply pieces of masking tape on glass at lower support spacers to provide exact location when installing glass.
(13) Cut tape below glass and remove glass.
(14) Apply a 3/16 inch wide bead of urethane around the entire windshield opening/fence.
(15) Using tape guides, carefully position glass in body opening.
(16) Press the glass to wet-out and set urethane. Use care to avoid excessive squeeze-out.
(17) Remove masking tape from glass and body.
(18) Remove excess urethane using naptha on a clean cloth.
(19) Water test installation.
(20) If water leaks are encountered, apply extra urethane at leak point.
(21) Install interior garnish moldings.
(22) Position windshield side molding on A-pillar and install attaching screws.
(23) Install A-pillar watherseals.
(24) Install cowl top grille panels.
(25) Install windshield wiper blade and arm assemblies.

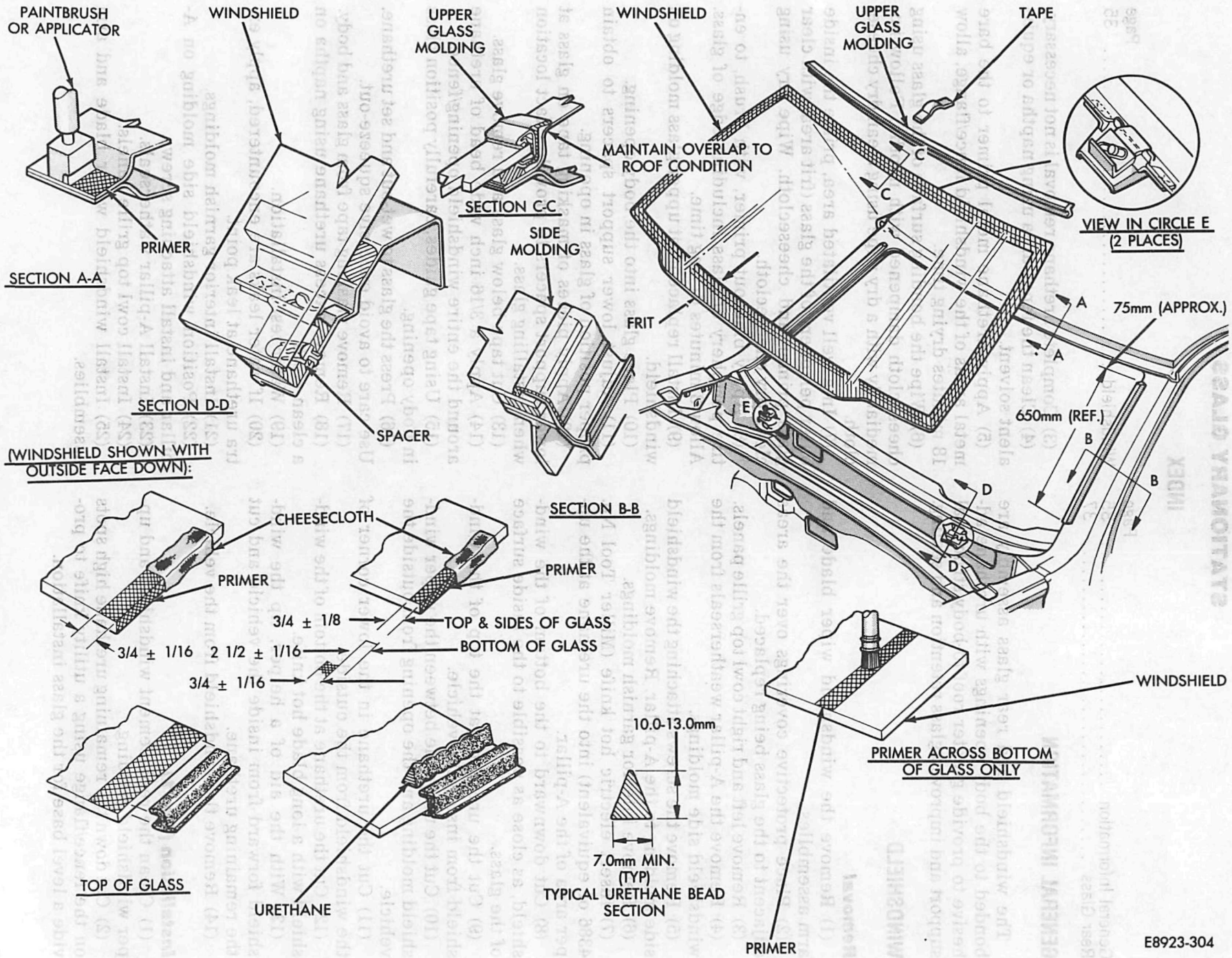


Fig. 1—Windshield Glass Installation

REAR GLASS

Removal

(1) Remove rear seat cushion and back.
(2) Remove cargo shelf mounted stoplight, if equipped.
(3) Remove rear quarter trim panels.
(4) Disconnect rear window defogger, if equipped.
(5) From inside the vehicle, cut the urethane upper and side seals with a long blade cold knife.
(6) Pull the cargo shelf carpet back to expose the lower seal.
(7) Cut the urethane lower seal with a long blade cold knife.
(8) With the aid of a helper, push on the glass along the upper seal area and cut remaining urethane retaining glass in opening.
(9) Remove the rear glass.

Installation (Fig. 2)

(1) Clean the replacement rear glass assembly.
(2) Cut down the remaining urethane high spots on the fence/flange using a utility knife to provide a level base for the glass installation.
(3) Complete urethane removal is not necessary.
(4) Clean the fence area using naptha or equivalent solvent.
(5) Apply urethane metal primer to the bare metal areas of the rear window fence/flange, allow 18 minutes drying time.
(6) Wipe the bonding surface of the glass and lower molding using cheesecloth dampened with naptha. Follow immediately with a dry wipe using clean dry cheesecloth.
(7) In a well ventilated area, prime the inside outer periphery of the glass (frit area) and lower molding with clear glass primer and cheesecloth. Wipe dry using clean dry cheesecloth.
(8) Apply blackout primer, with brush, to top and sides of glass periphery. Allow 3 minutes drying time.
(9) Tape vertical grid elements of defogger with masking tape for installation protection.
(10) Apply a 9/32 inch wide bead of urethane along the top and sides of glass.
(11) Apply a 3/16 inch wide bead of urethane on the lower molding, along the rivet line.
(12) Place the glass assembly in position on the body opening.
(13) Press the glass to wet-out and set the urethane. Use care to avoid excessive squeeze-out.
(14) Apply six pieces of masking tape, from glass across molding onto body, to retain glass in position.
(15) Remove excess urethane using naptha on a clean cloth.
(16) Water test installation.
(17) If water leaks are encountered, apply extra urethane at leak point.
(18) Remove masking tape protecting vertical grid elements of defogger, if equipped.
(19) Connect rear window defogger, if equipped.
(20) Place cargo shelf carpet in position.
(21) Install rear quarter trim panels.
(22) Install cargo shelf mounted stoplight, if equipped.
(23) Install rear seat back and cushion.

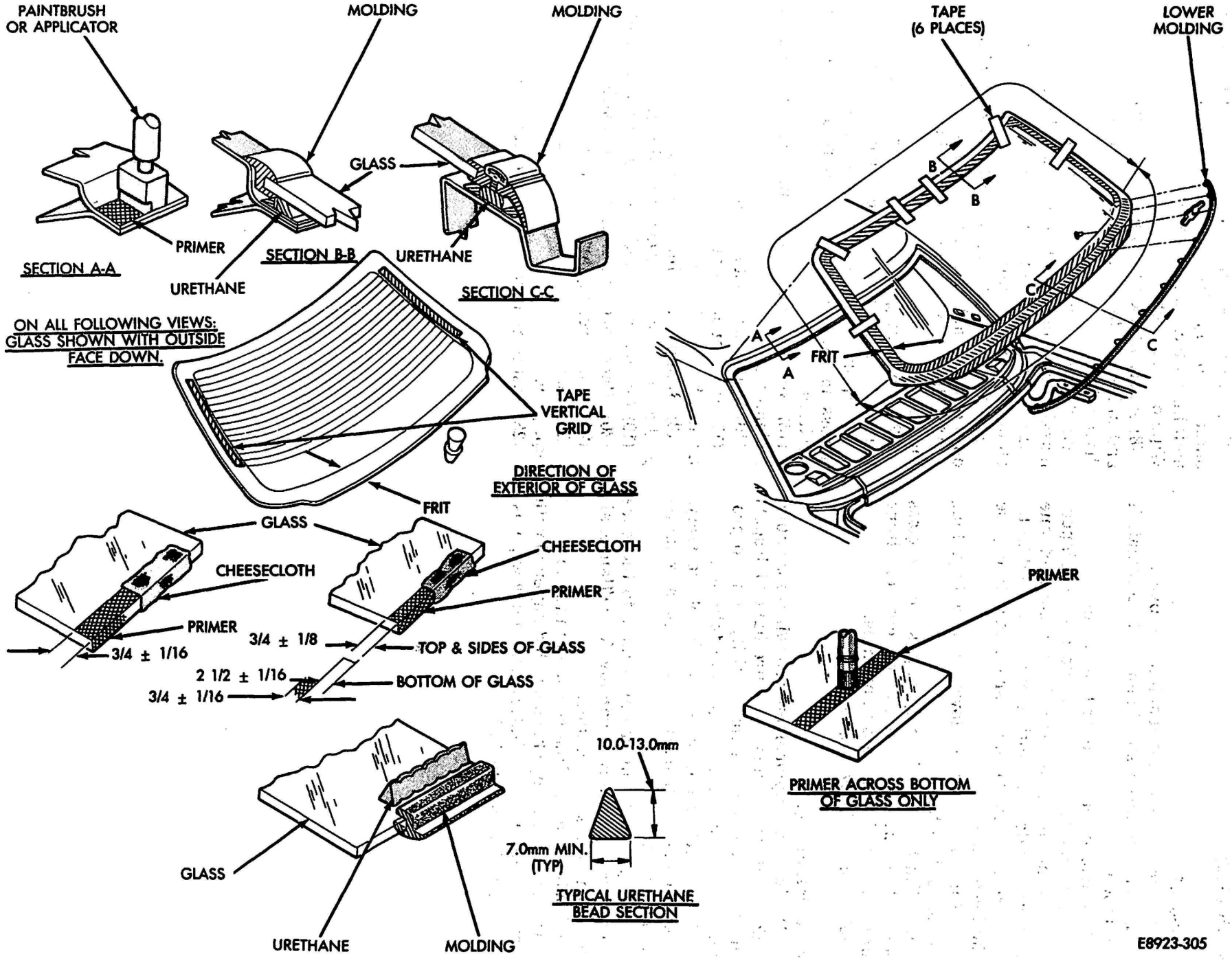


Fig. 2—Rear Glass Installation

HEATING AND AIR-CONDITIONING

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COMPONENT DESCRIPTION	34	REFRIGERANT SYSTEM SERVICE	44
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HEATER OPERATION

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The following is a description of operation for a vehicle equipped with only heat and ventilation (no A/C).

ENGINE COOLING SYSTEM REQUIREMENTS

To maintain adequate temperature levels from the heater/air conditioning system, the engine cooling system must be prepared as described in Group 0, Lubrication and Maintenance.

The use of a bug screen is not recommended. Any obstructions forward of the radiator or condensor can reduce the effectiveness of the air conditioning or engine cooling system.

DESCRIPTION

The heater assembly is a blend air system, receiving outside air through the blower inlet, which is connected directly to an opening in the upper cowl. Outside air is drawn into the system from the cowl, through the blower inlet into the blower housing. It is forced through and/or around the heater core, mixed, and then discharged through the floor, instrument panel or defroster outlets.

CONTROL ASSEMBLY

The control switch assembly (Fig. 1) is located in a pod on the right side of the steering column. The control assembly contains the mode selection switch, which controls the mode of operation for the heating system. Also located in the control switch assembly is the blower speed selection switch, which controls the volume of air movement, and the defroster push-button which can be activated to override the normal mode selection switch for immediate front windshield defroster activation. Another control incorporated in the power ventilation system is the temperature control lever.

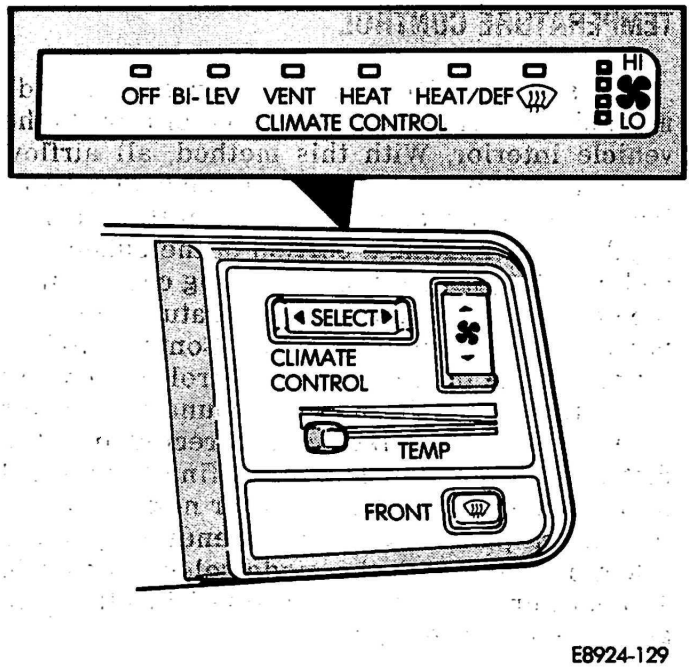


Fig. 1—Control Switch and Panel w/o A/C

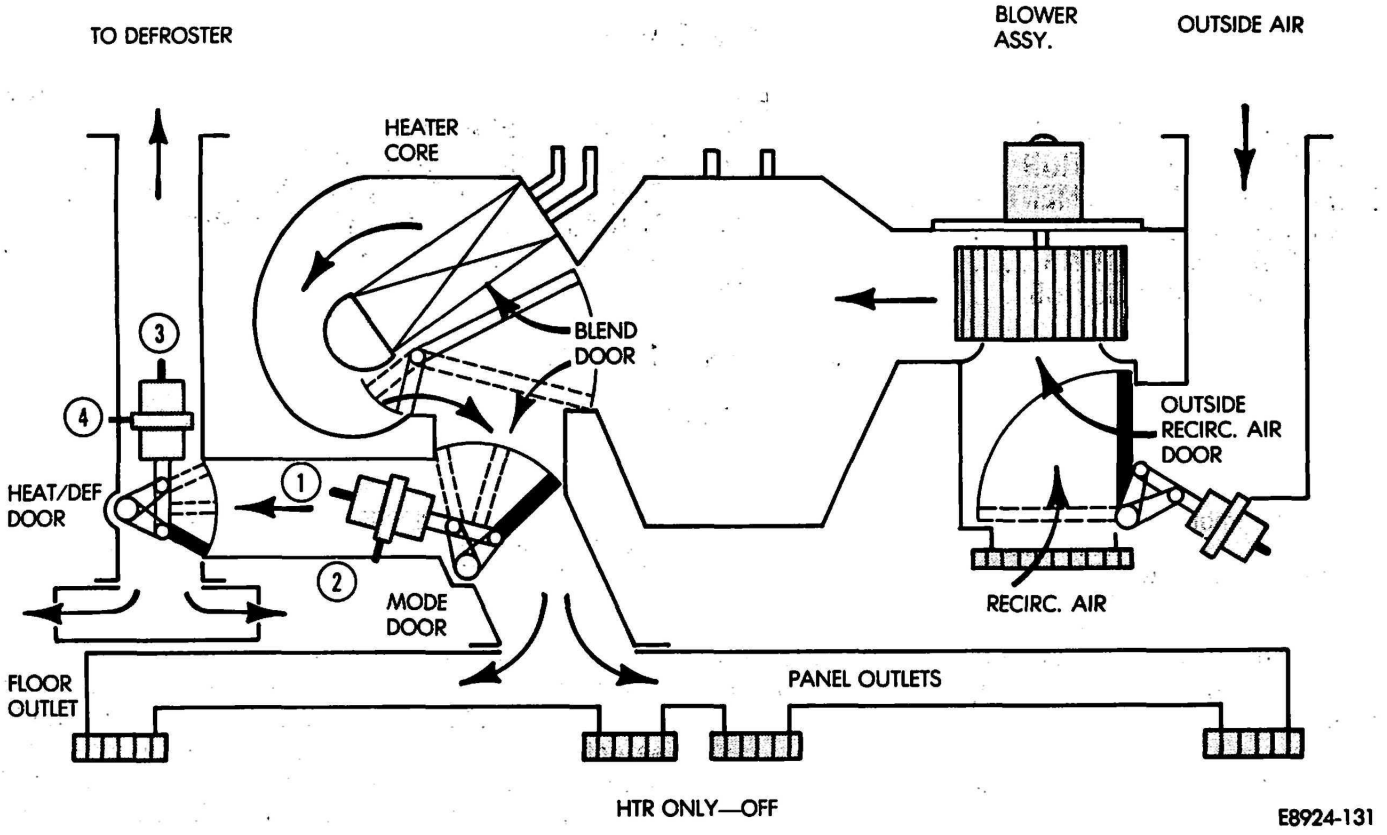


Fig. 2—Heater Only—Off Mode

TEMPERATURE CONTROL

The system utilizes a "temperature blend" method to provide controlled temperature to the vehicle interior. With this method, all airflow from the blower passes through the heater housing to the plenum assembly. Temperature is then regulated by heating a portion of the outside air and blending it with the remaining cooler air to the desired temperature. Temperature blending is varied by means of the Air Control Module activating the blend door to control the amount of air that flows through or around the heater core, where it is mixed and directed into the distribution plenum. The air is finally directed to the heater ducts, the defroster nozzles, or the instrument panel registers, depending upon the selection made with the mode selection switch. Temperature control is permitted in all of the available modes of operation.

HEATER-ONLY CONTROL MODES

The operating modes available on the heater-only control are:

- OFF
- BI/LEVEL
- VENT
- HEAT
- HEAT/DEFROST
- DEFROST

The desired hot/cold air blend is adjusted manually with a slide potentiometer located on the control pod.

Off

Off mode (Fig. 2) is entered by depressing the left side of the SELECT rocker button until the mode light is illuminated. In this mode, the blower speed lights are blanked; the blower is off. The recirculation door is in the recirculate position and the mode doors are in defrost.

Bi/Level

In the bi/level mode (Fig. 3), the blower is operational through its range. Also, for bi/level operation, the air is directed to both panel and floor outlets, and the recirculation door is in the Outside Air position.

Vent

For vent mode (Fig. 4), the recirculation door is in the Outside Air position, and air is directed to panel outlets.

Heat

For heater mode (Fig. 5), the selection is made as indicatd previously, except that a blower delay may be introduced. In this mode, the air is directed to the floor outlets.

Blower Delay: A ten minute blower delay will be introduced at the beginning of a driving session if all of the following conditions are met:

- The vehicle had been left in heater or heater/defrost mode at the end of the last driving session.
- The coolant temperature is less than 120°F.
- The Electronic Control Unit (ECU) interface is operating correctly (blower delay is not used if the ECU line is shorted to ground or open).

During a blower delay interval the display panel shows the current active mode; heater or heater/defrost light will be illuminated. During the blower delay, the blower speed lights will be turned off, the recirculation door is closed to outside air, and the mode doors are set to defrost (see OFF mode).

The blower delay may be cancelled before the ten minute time-out if any of the following conditions occur:

- Engine coolant temperature is greater than 120°F.
- Operator changes mode, adjusts the temperature potentiometer, or selects blower operation.

By changing either set temperature or mode, the blower is activated at M1.

If the blower up FAN rocker button is depressed, the speed is set to M1, and after one second, begins to increment at a 500 millisecond rate as long as the button is depressed until the highest speed is reached.

Heat/Defrost

In heat/defrost mode (Fig. 6), the recirculation door is in the outside air position, and air is directed to both the defrost and floor outlets.

Defrost

For defroster operation (Fig. 7), press the DEFROST mode selection switch. Pressing the DEF push-button will override normal mode selection and provide for immediate defroster operation.

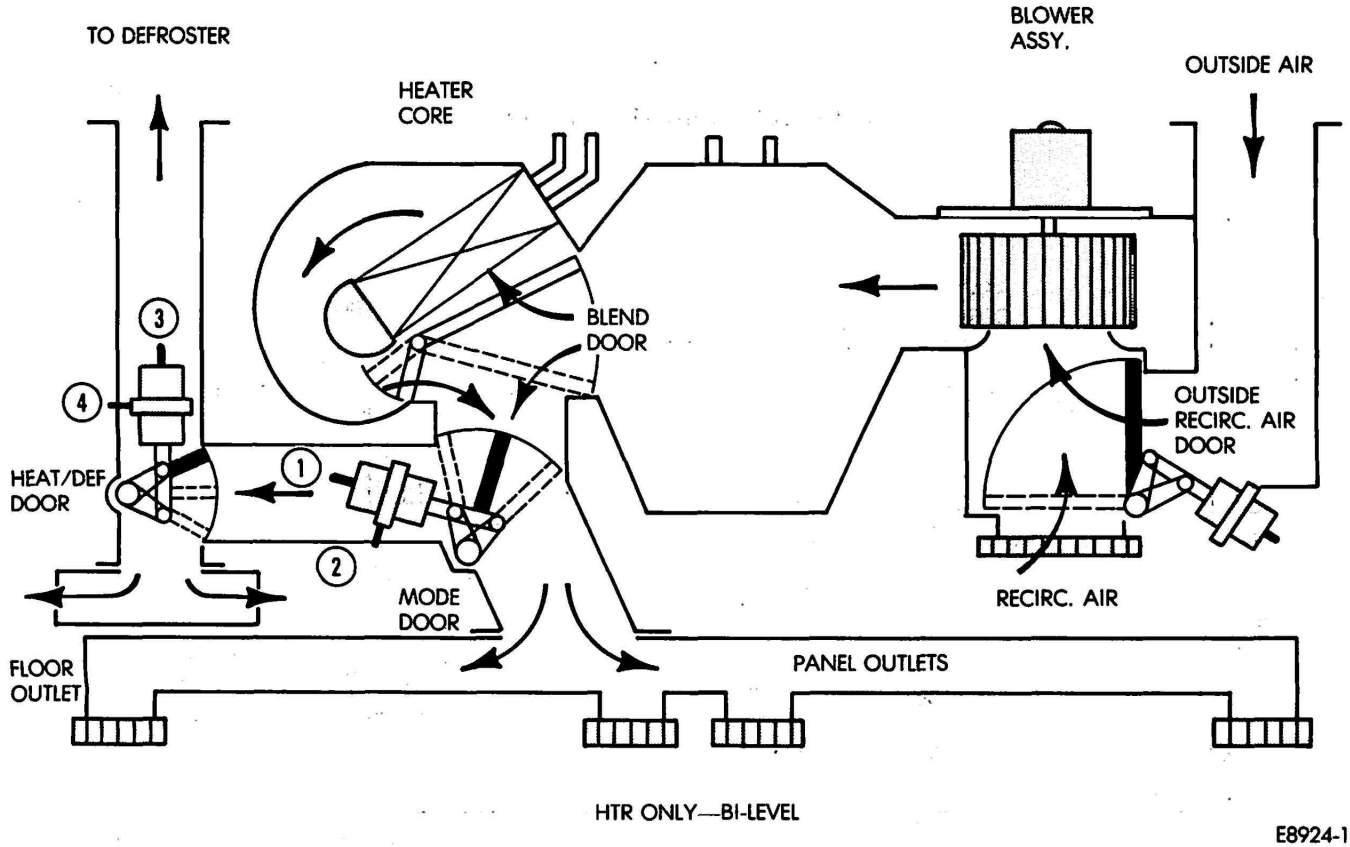


Fig. 3—Heater Only—Bi-Level Mode

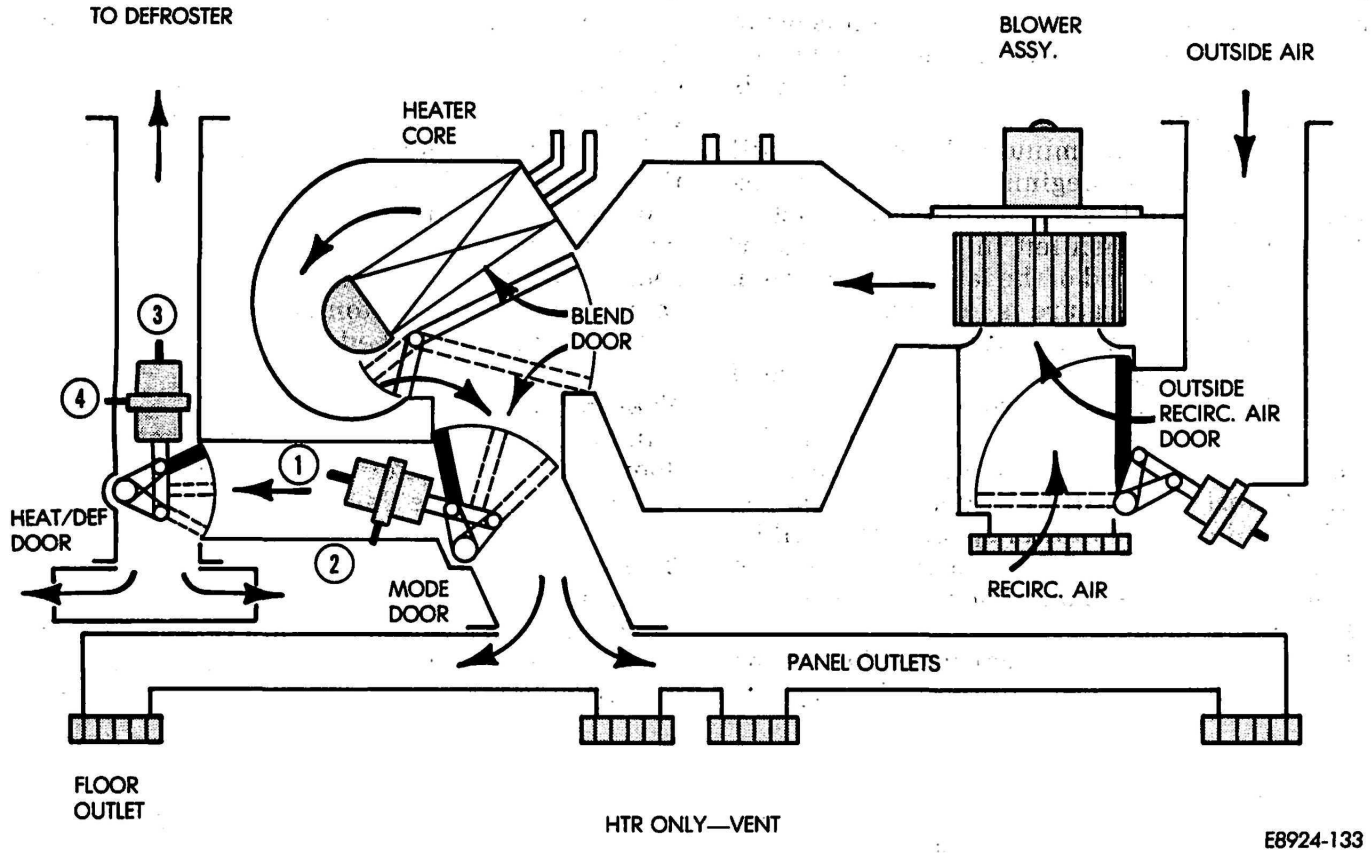


Fig. 4—Heater Only—Vent Mode

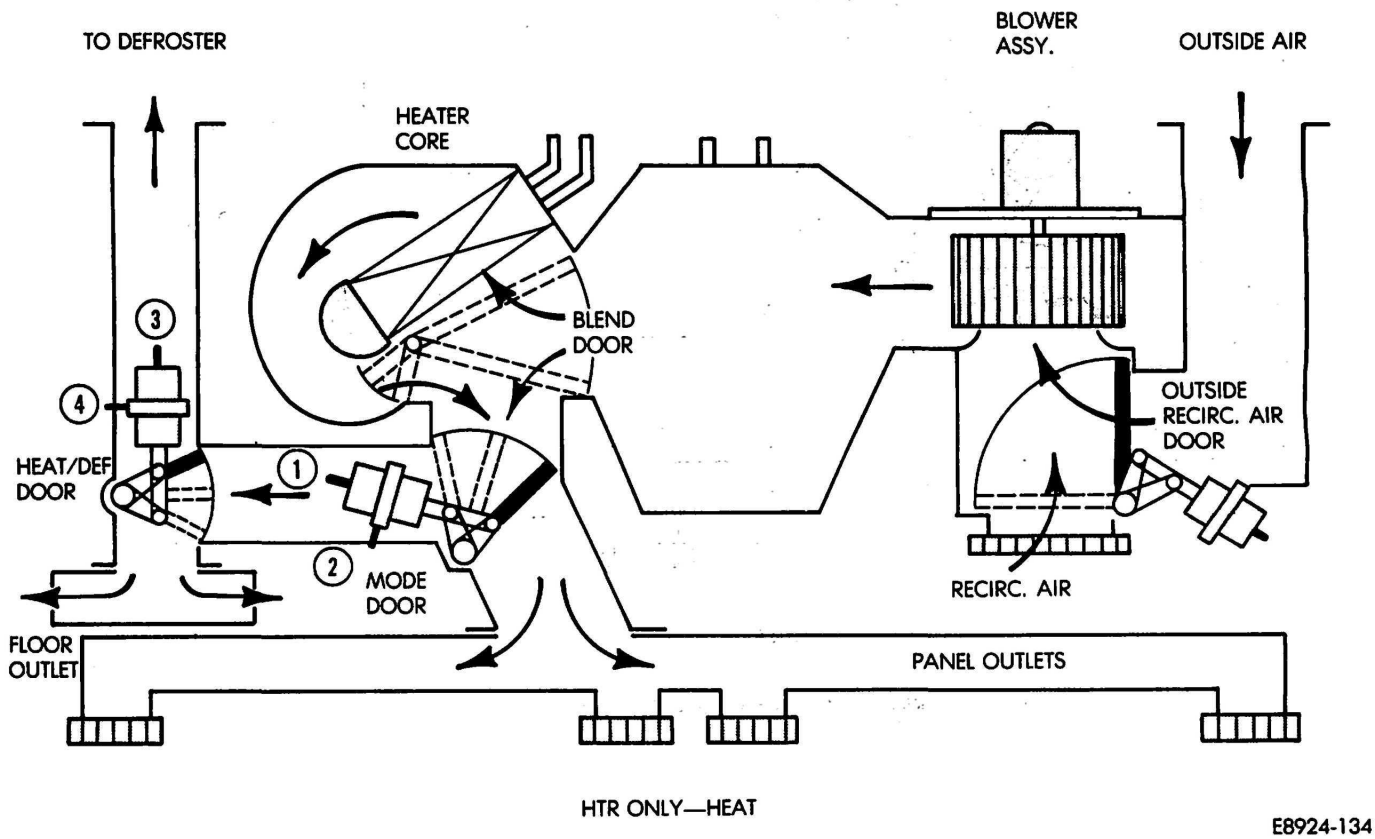


Fig. 5—Heater Only—Heat Mode

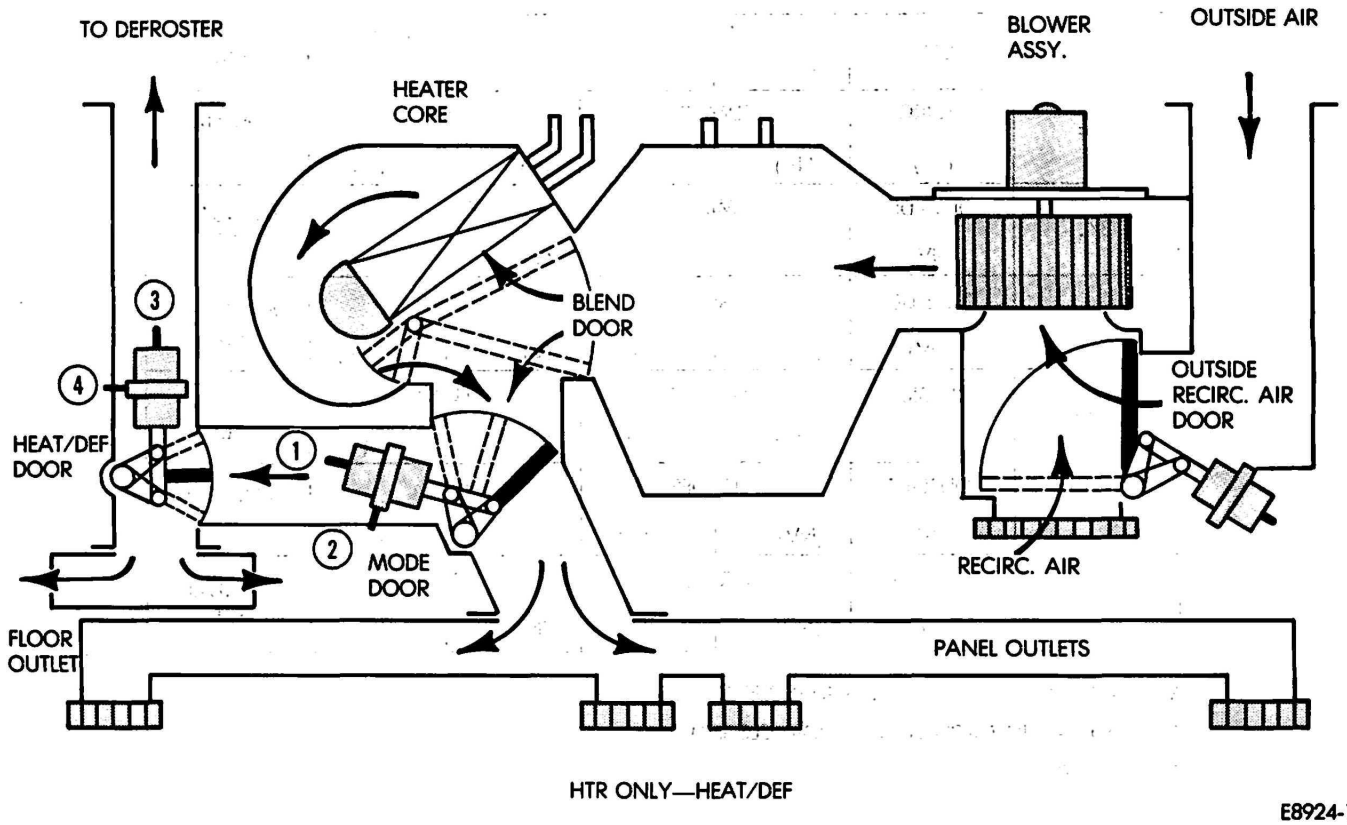


Fig. 6—Heater Only—Heat/Defrost Mode

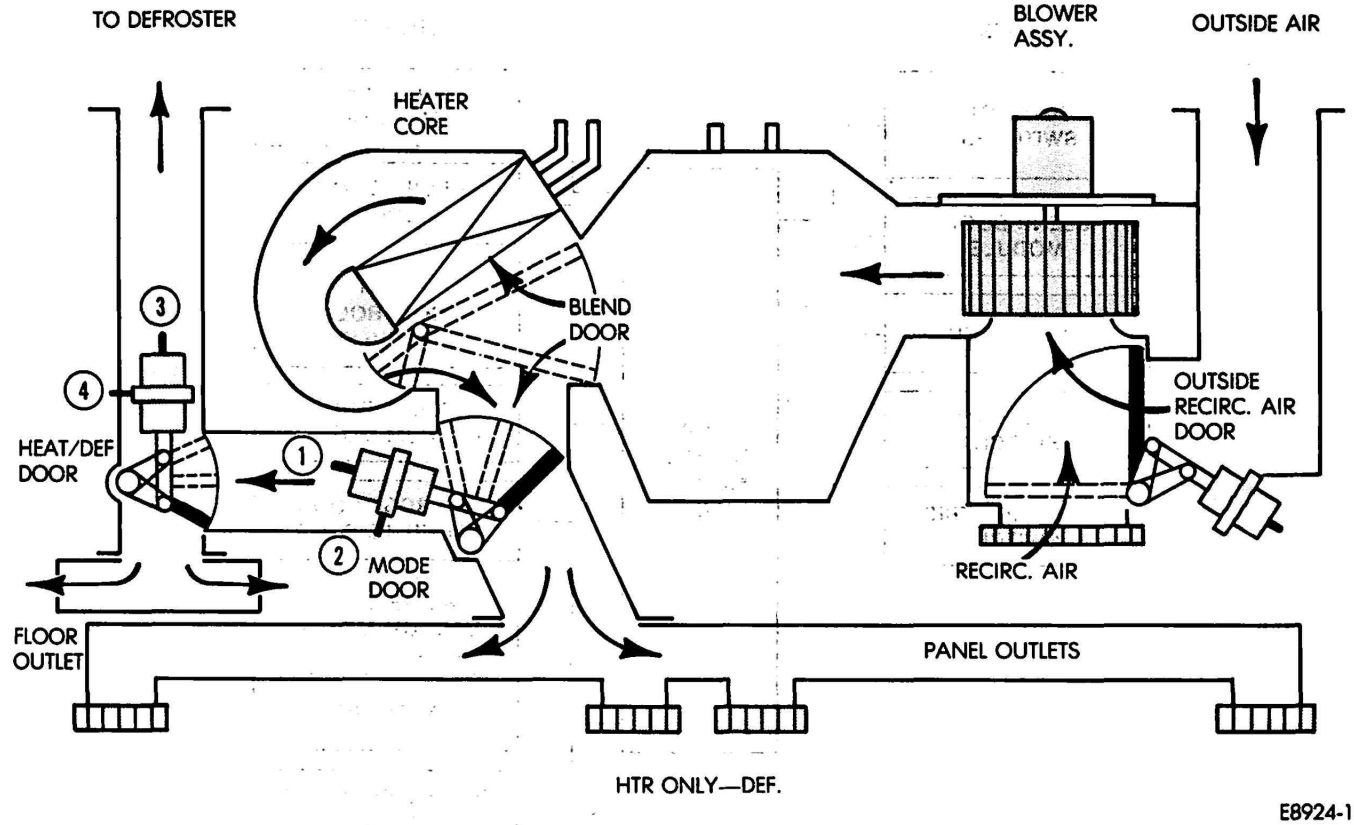


Fig. 7—Heater Only—Defrost Mode

HEATER VACUUM SCHEMATIC (Heater Only)

MODE	RECIRC	MODE 1 | 2	FLR/DEF 3 | 4	AIRMIX
OFF	RECIRC (NV)	FLR/DEF (NV) | (NV)	DEF (NV) | (NV)	MANUAL SET
B/L	OUTSIDE (NV)	MIX (V) | (NV)	FLOOR (V) | (V)	MANUAL SET
VENT	OUTSIDE (NV)	PANEL (V) | (V)	FLOOR (V) | (V)	MANUAL SET
HEAT	OUTSIDE (NV)	FLR/DEF (NV) | (NV)	FLOOR (V) | (V)	MANUAL SET
HT/DEF	OUTSIDE (NV)	FLR/DEF (NV) | (NV)	MIX (V) | (NV)	MANUAL SET
DEF	OUTSIDE (NV)	FLR/DEF (NV) | (NV)	DEF (NV) | (NV)	MANUAL SET

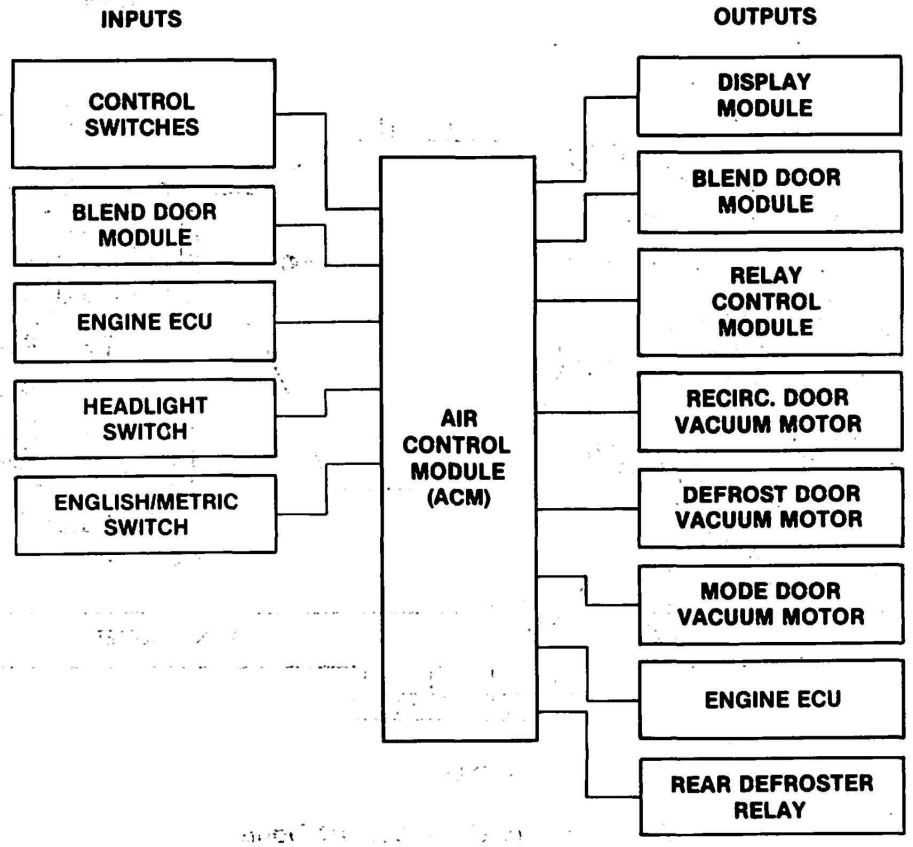
V=VACUUM APPLIED BY SOLENOID (SOLENOID OPEN)

NV=NO VACUUM APPLIED (SOLENOID CLOSED)

FLR=FLOOR

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HEATING CONTROL SYSTEM DIAGRAM (Heater Only)



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SEMIAUTOMATIC CLIMATE CONTROL

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DESCRIPTION

The electronic semiautomatic climate control is available as an option on Premier models. This system is graphically represented in the following block diagram.

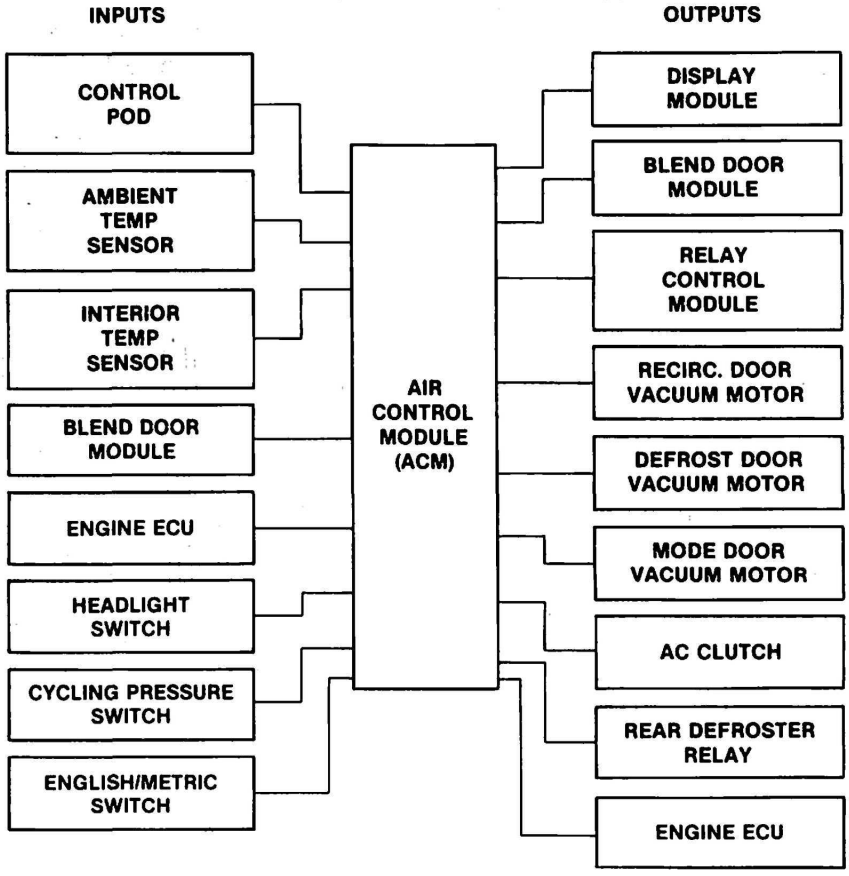
With the use of a microcomputer, the Air Conditioning Control Module (ACM) analyzes inputs from the following major sources:

- Temperature, mode, and blower selections (made manually).
- Vehicle interior temperature sensor.
- Ambient temperature sensor.
- Blend door module.
- Engine control module (ECU).
- Headlamp switch.
- Cycling pressure switch.
- English/metric switch.

Using these inputs, the microcomputer determines the correct conditions for the following outputs:

- Display module.
- Blend door module.
- Relay control module.
- Recirculation door vacuum motor.
- Defrost door vacuum motor.
- Mode door vacuum motor.
- A/C compressor clutch engagement.
- Rear defroster relay.
- Engine ECU.

A small DC electric motor or actuator is used to operate the temperature blend door. A feedback circuit is used in the blend door actuator to supply the control with blend door position information. Vacuum actuators are used to control each of the three remaining air distribution doors.



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ENGINE COOLING SYSTEM REQUIREMENTS

To maintain adequate temperature levels from the heater/air conditioning system, the engine cooling system must be prepared as described in Group 0, Lubrication and Maintenance.

The use of a bug screen is not recommended. Any obstructions forward of the radiator or condensor can reduce the effectiveness of the air conditioning or engine cooling system.

OPERATION

The heater assembly is a blend air system, receiving outside air through the blower inlet, which is connected directly to an opening in the upper cowl. Outside air is drawn into the system from the cowl, through the blower inlet into the blower housing. It is forced through and/or around the evaporator and/or heater core, mixed, and then discharged through the floor, instrument panel or defroster outlets.

The electronic climate control system automatically maintains the temperature selected for driving comfort and regulates the air flow between the instrument panel registers, floor ducts, windshield defroster nozzle and side window demisters as selected by the driver.

Control of the passenger compartment temperature may be maintained in all function control settings, except when the system is turned off. In hot weather, it will cool the vehicle to a comfortable level then maintain the interior temperature at that level automatically. The reverse will be true in cold weather conditions.

CONTROL MODULE

The electronic automatic temperature control module is located on the steering column pod. The module consists of 5 switches which control system operation (Fig. 1).

The select switch controls the selections of the various operating modes and the indicator display on the instrument panel. The blower motor speed switch controls the blower motor speed with current speed setting indicated on the display panel. The set temperature can be raised or lowered in one degree increments between 18 to 29°C (65 to 85°F) through the use of the temperature control switch. There is also a 16°C (60°F) setting for maximum cooling and a 32°C (90°F) setting for maximum heat. The currently set temperature is displayed on the display panel.

DISPLAY MODULE

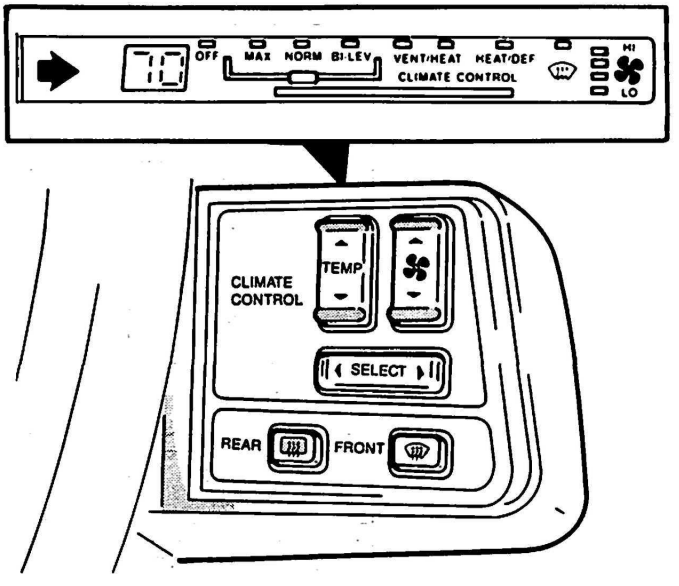
This module consist of twelve bar-type indicators and a two digit LCD seven-segment display. There are eight mode functions and four blower speed indicators. The display module is located in the instrument panel, just below the drivers cluster and above the steering column.

BLOWER SPEED CONTROL

A four speed blower operates in every mode except OFF. The blower speed is selected by pressing at the top or bottom of the rocker switch located on the control switch pod. By pressing the top or bottom of the switch the blower speed can be increased or decreased. The blower speed indication changes immediately in the proper direction when the blower select switch is pressed. If the switch remains pressed for longer than one second, the speed indication will continue to advance every 1/2 second until the switch is released or the indicator reaches the end of the display. When the switch is released or the end of travel is reached the selected blower speed is achieved immediately. When OFF mode is selected the blower is turned off. The speed will be set to low when the OFF mode is exited.

Blower Delay

Blower Delay: A ten minute blower delay will be introduced at the beginning of a driving session if all of the following conditions are met:



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Fig. 1—Control Switch Module

• The vehicle had been left in heater or heater/defrost mode at the end of the last driving session.
• The coolant temperature is less than 120°F.
• The ambient temperature is below 70°F and the ambient sensor line is not open nor shorted to ground.
• The Electronic Control Unit (ECU) interface is operating correctly (blower delay is not used if the ECU line is shorted to ground or open).

During a blower delay interval the display panel shows the current active mode and set temperature; but the blower speed lights will be turned off. The recirculation door is closed to outside air, and the mode doors are set to defrost (see OFF mode).

The blower delay may be cancelled before the ten minute time-out if any of the following conditions occur:
• Engine coolant temperature is greater than 120°F.
• The ambient temperature increases above 70°F or the ambient temperature sensor line is found to be open or shorted to ground.

By changing either set temperature or mode, the blower is activated at M1.

If the blower up FAN rocker button is depressed, the speed is set to M1, and after one second, begins to increment at a 500 millisecond rate as long as the button is depressed until the highest speed is reached.

RELAY SETTINGS

The following is a schematic of the blower control module. When each of the four available blower speeds becomes active, the blower relays are set as shown in the table. Relays provide ground circuits rather than power to control blower speeds.

BLOWER RELAY CONTROL MODULE

This module provides four blower speeds, manually controlled from the control switch module rocker button. There are three relays mounted on the air conditioning housing. The control circuitry provides grounding for the relay coils.

MODE SELECTION

The available operating modes are shown in a row on the separate display panel. They are selected by pressing the left or right side of the mode selection rocker switch. To advance the selected mode to the left or right press on the left or right side of the mode selection switch respectively. The selected mode is indicated by an illuminated segment on the display panel. The mode indication moves immediately when the mode selection switch is pressed. If the switch remains pressed for longer than one second, the mode indicator advances in the same direction again, and continues to advance in that direction every half second until the switch is released or the end of the available mode selections is reached. When the switch is released or the end of travel is reached, a one second delay begins. If the mode indicator is not moved during the delay, the selected mode is asserted at the end of the delay. If the mode indicator is moved during the delay, the delay is cancelled and the old mode is retained until the new mode selection and a new 1 second delay are complete.

SEMIAUTOMATIC CONTROL MODE FUNCTION

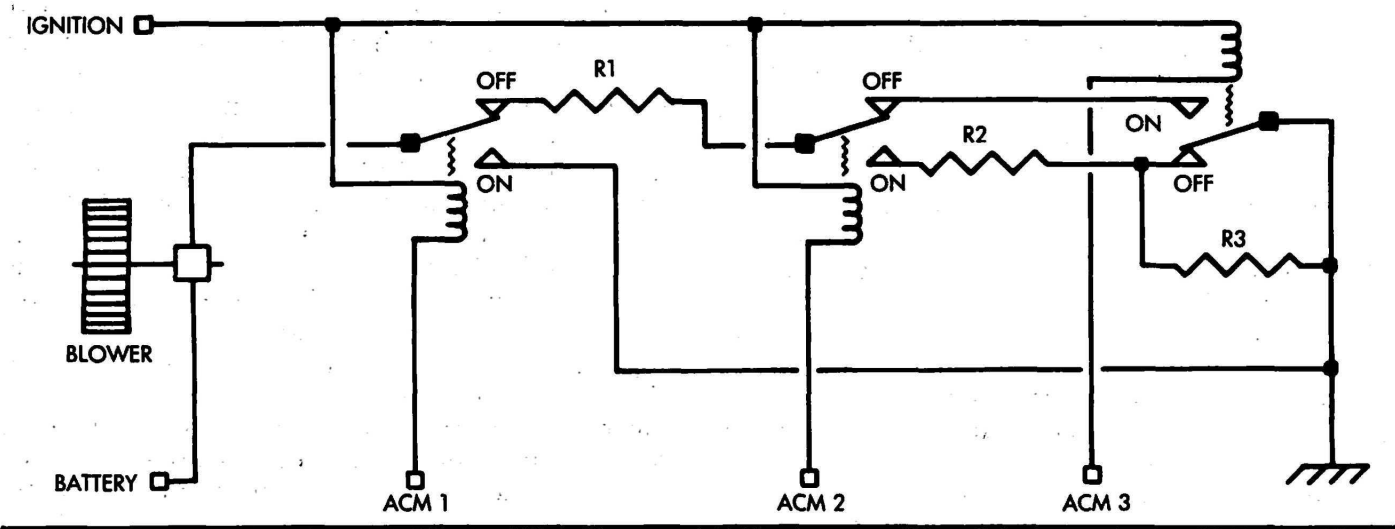
The semiautomatic control modes available are:
• OFF
• A/C MAX
• A/C NORM
• A/C BI/LEVEL
• VENT
• HEAT
• HEAT/DEFROST
• DEFROST

Off

Off mode (Fig. 2) is entered by depressing the left side of the SELECT rocker button until the mode light is illuminated. In this mode, the display and blower speed lights are blanked; the blower and A/C clutch are off. The recirculation door is in the recirculate position and the mode doors are in defrost.

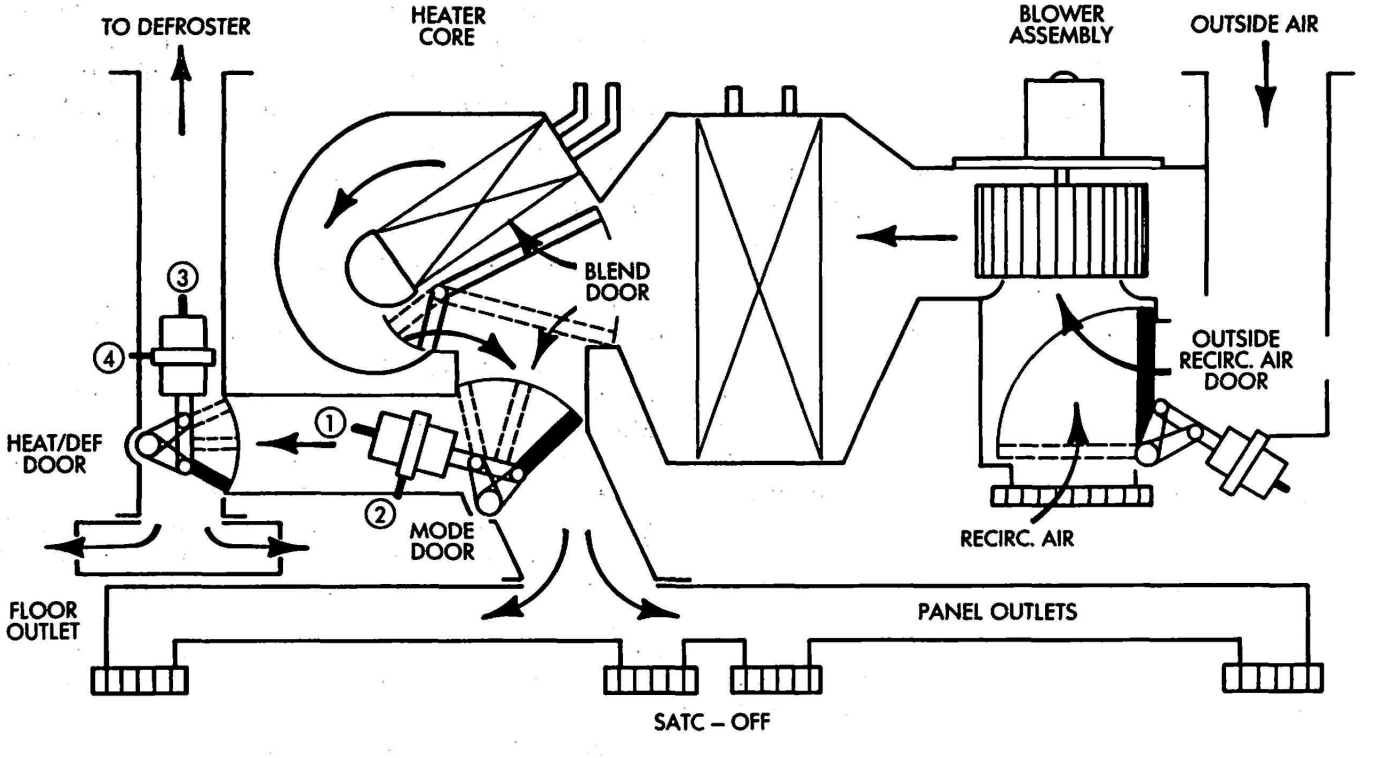
A/C (Max, Norm, Bi/Level)

The air conditioning mode A/C is entered by depressing either side of the SELECT rocker button and scanning the mode functions until the appropriate light is illuminated. In these modes (Max, Norm Bi/Level) the blower is operational through its range and the A/C clutch is engaged, depending on evaporator pressure. For MAX A/C operation (Fig. 3), the recirculation door is in the recirculate position and air is directed to upper outlets as for NORM A/C operation (Fig. 4). Also, the set temperature operation is the same as for NORM A/C mode. For Bi/Level operation (Fig. 5), the air is directed to both panel and floor outlets, and the recirculation door is in the Outside Air position.



Blower Speed	Relay			Series Resistance
	1	2	3	
Off	Off	Off	Off	
Low	Off	On	On	R1 + R2 + R3
Medium 1	Off	On	Off	R1 + R2
Medium 2	Off	Off	On	R1
High	On	Off	Off	0

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Fig. 2—Semiautomatic Control—Off Mode

Vent

For vent mode (Fig. 6), the air distribution is the same as for NORM A/C except that the A/C compressor is disengaged. The recirculation door is in the Outside Air position, and air is directed to panel outlets.

Heat

For heater operation (Fig. 7), the selection is made as indicated previously, except that the A/C compressor is disengaged, and a blower delay may be introduced, refer to Blower Delay. In this mode, the air is directed to the floor outlets.

Heat/Defrost

In heat/defrost mode (Fig. 8), the recirculation door is in the outside air position, and most air is directed toward the windshield. A/C compressor operates in this mode depending on evaporator pressure. Blower delay may occur (refer to Blower Delay).

Defrost

For defrost operation (Fig. 9), press the mode selection switch until DEFROST is selected. Pressing the DEF push-button will override normal mode selection and provide for immediate defroster operation. As in heat/defrost mode, the A/C clutch operates depending on evaporator pressure.

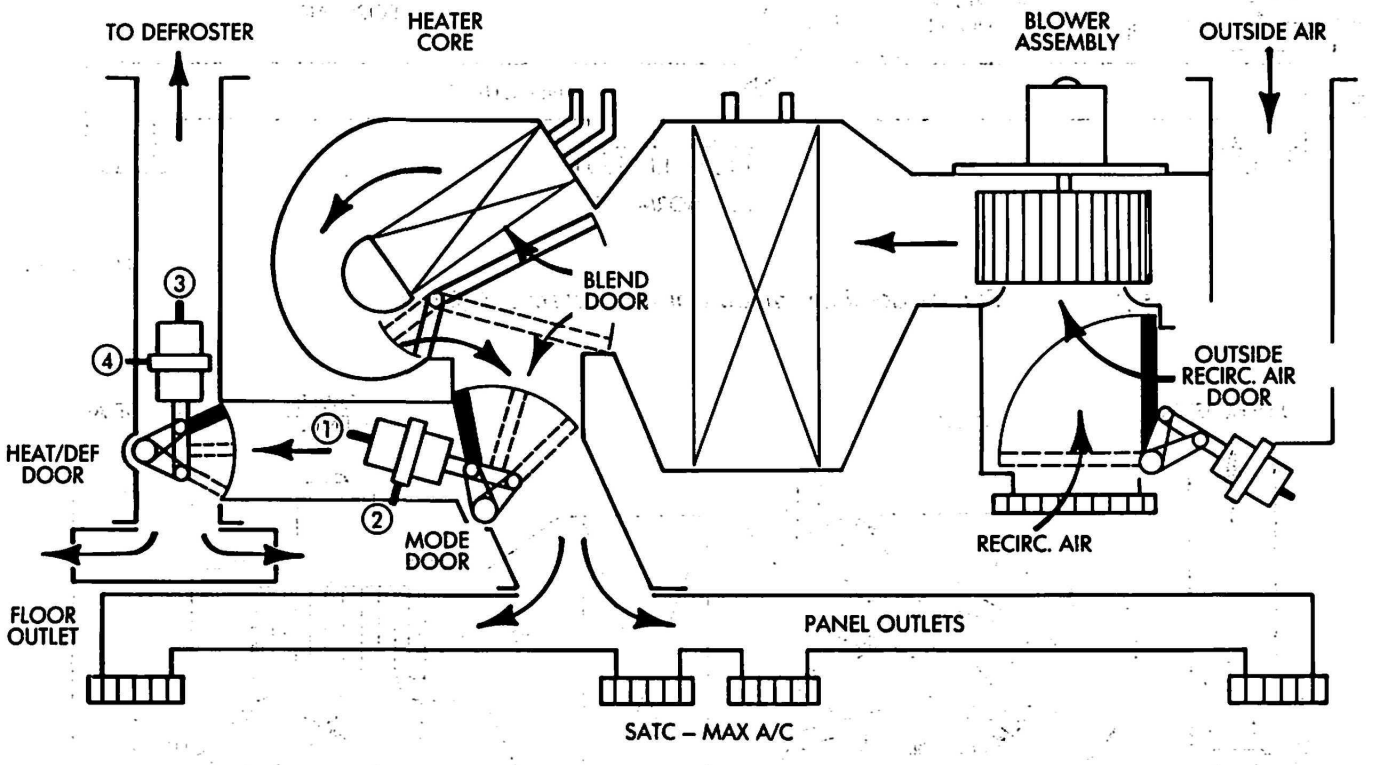


Fig. 3—Semiautomatic Control—Max. A/C Mode

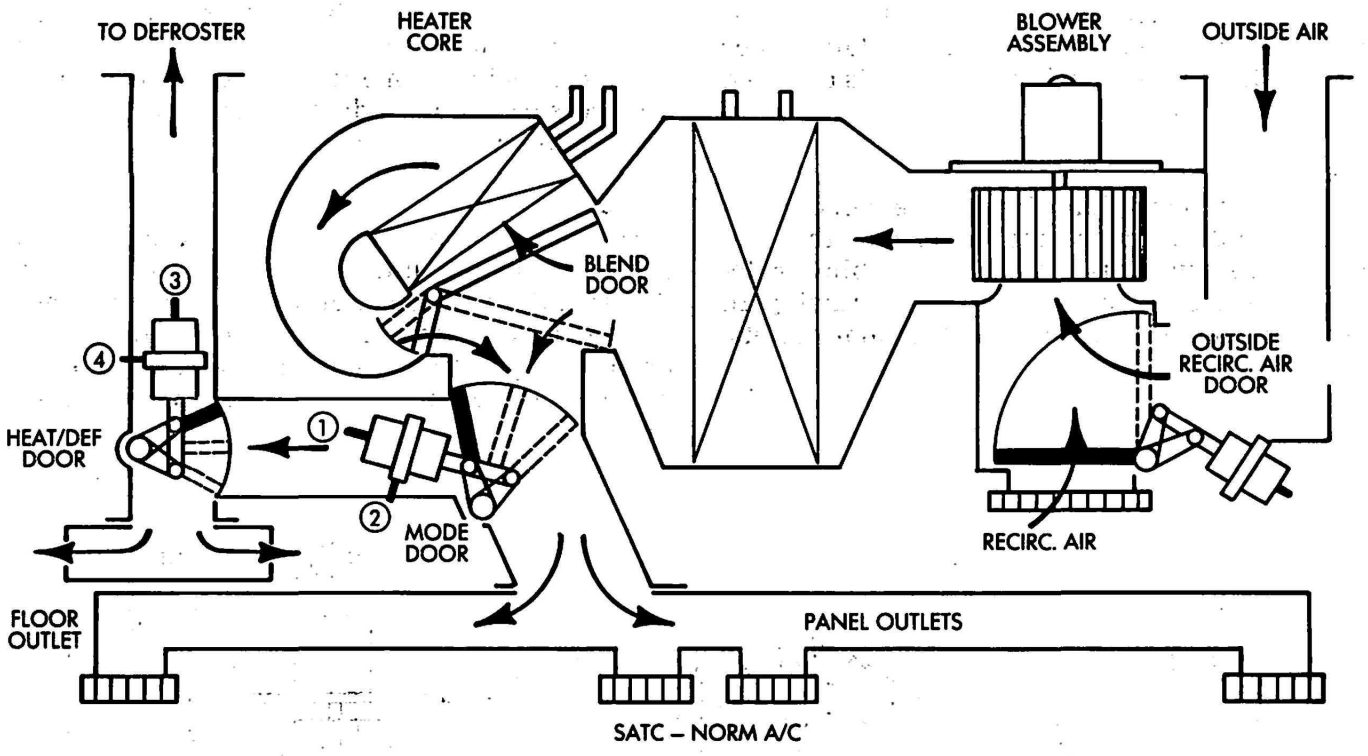


Fig. 4—Semiautomatic Control—Norm A/C Mode

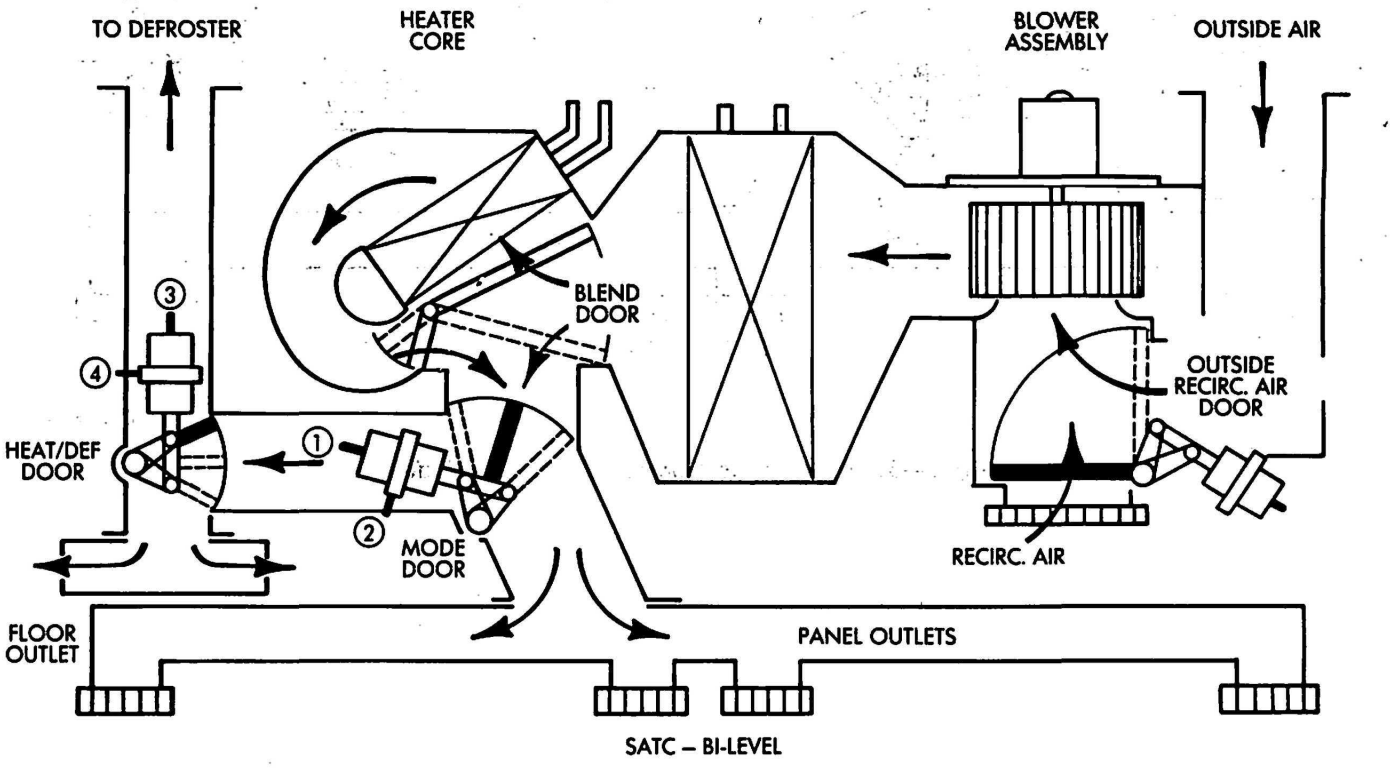


Fig. 5—Semiautomatic Control—Bi-Level Mode

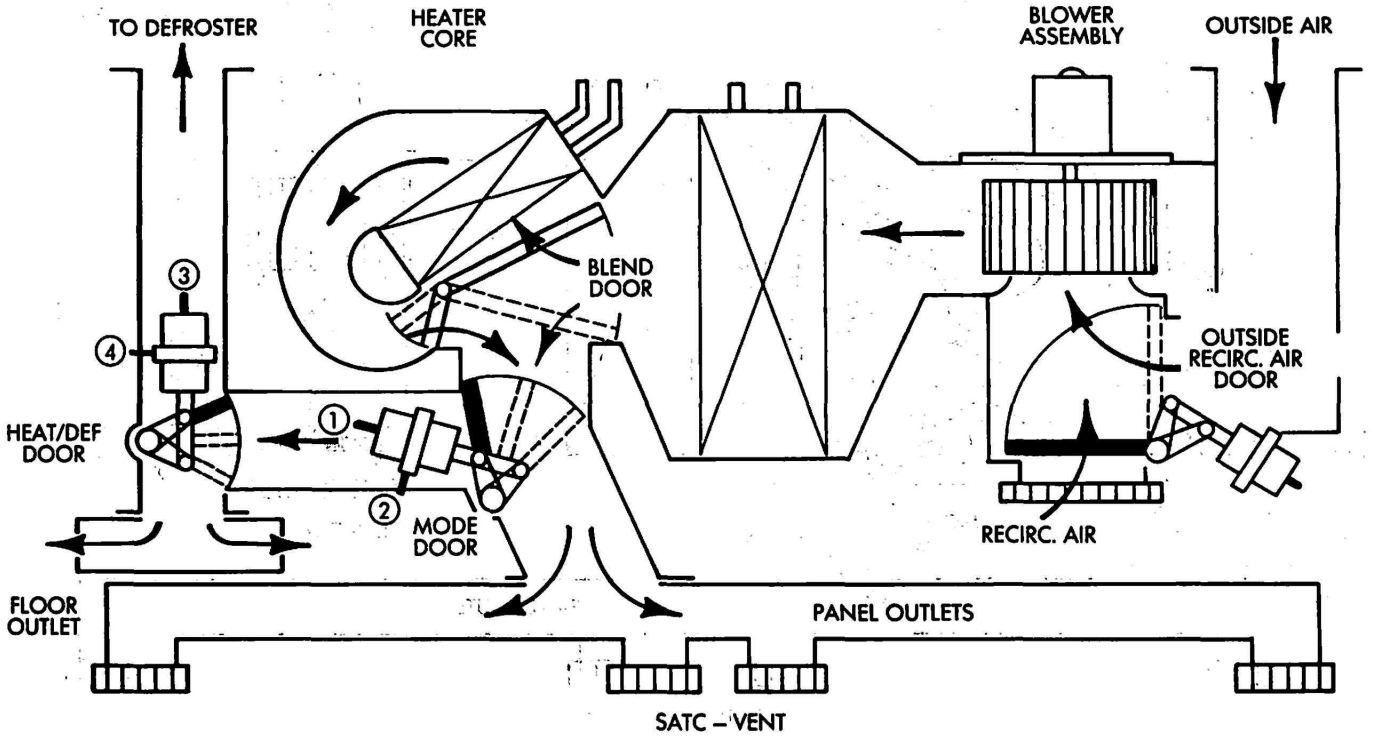


Fig. 6—Semiautomatic Control—Vent Mode

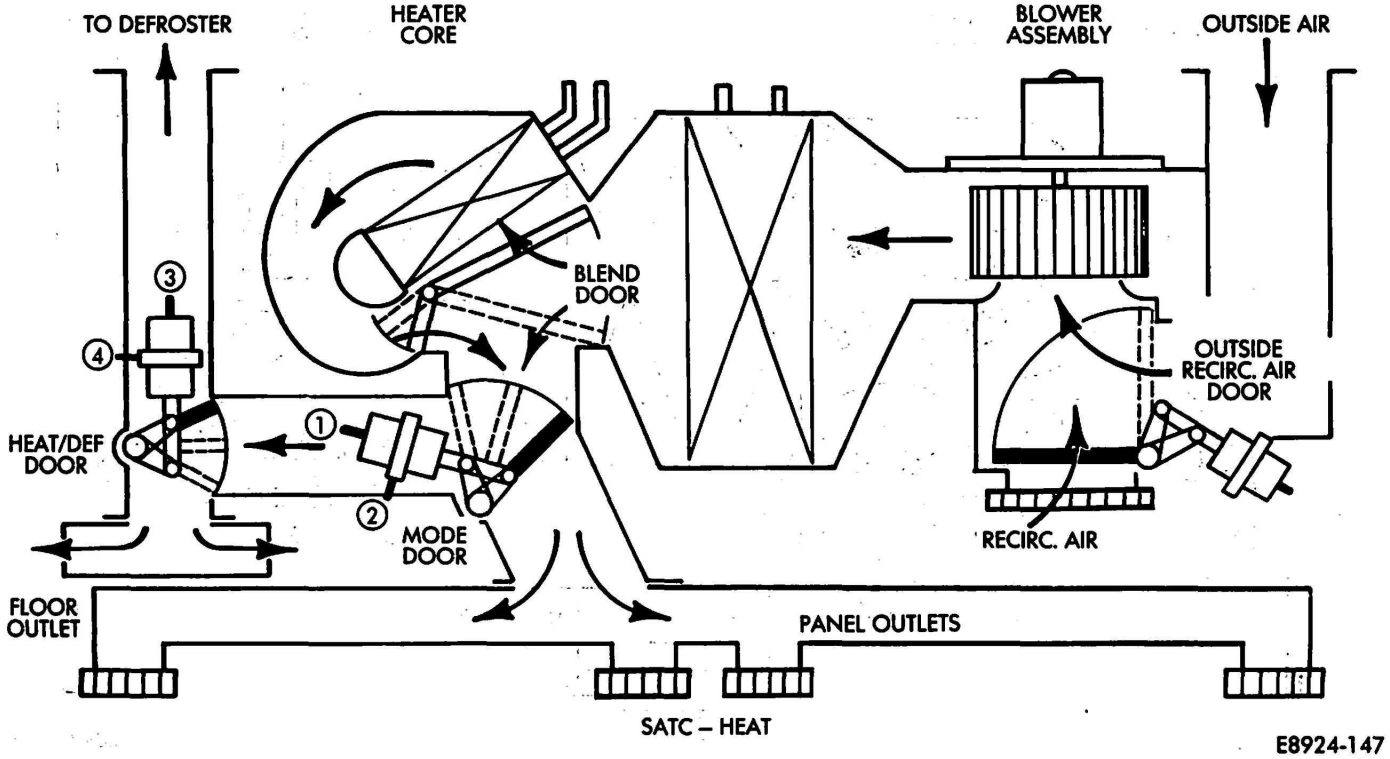


Fig. 7—Semiautomatic Control—Heat Mode

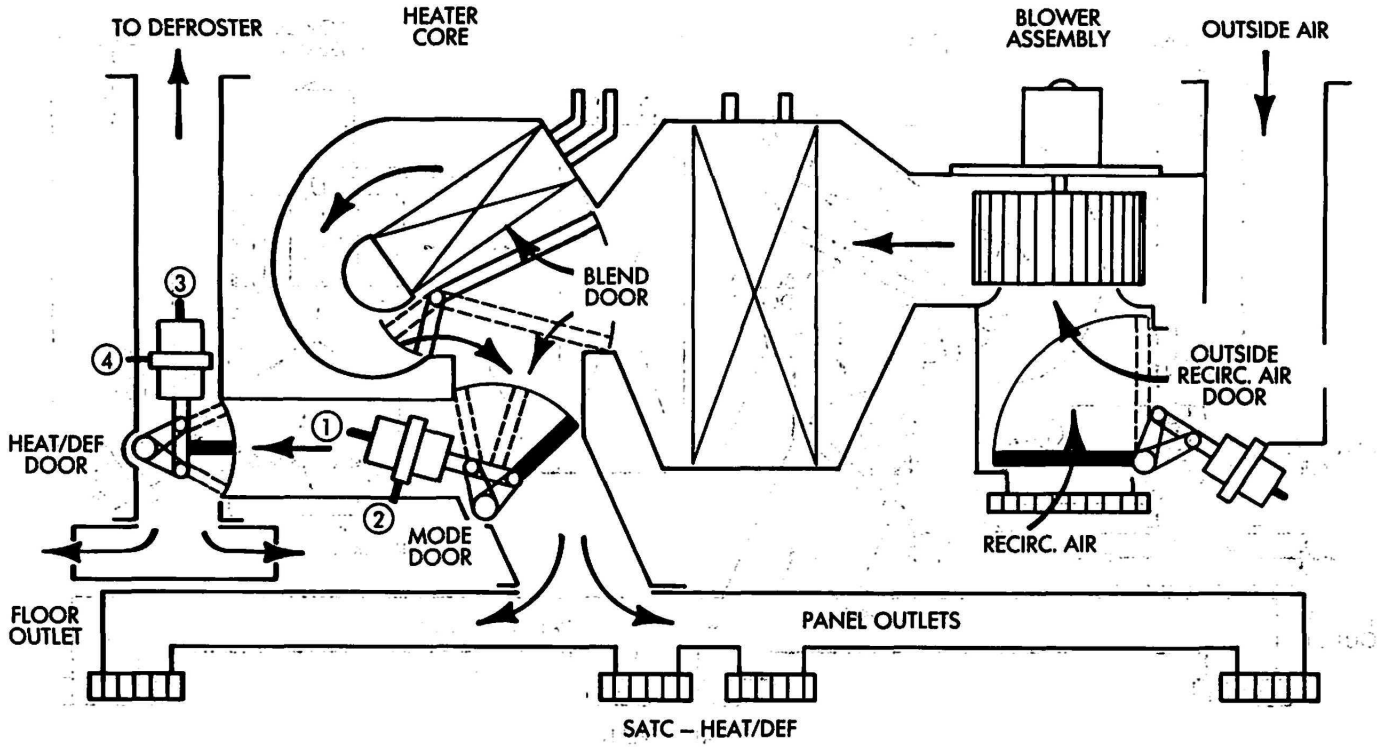


Fig. 8—Semiautomatic Control—Heat/Defrost Mode

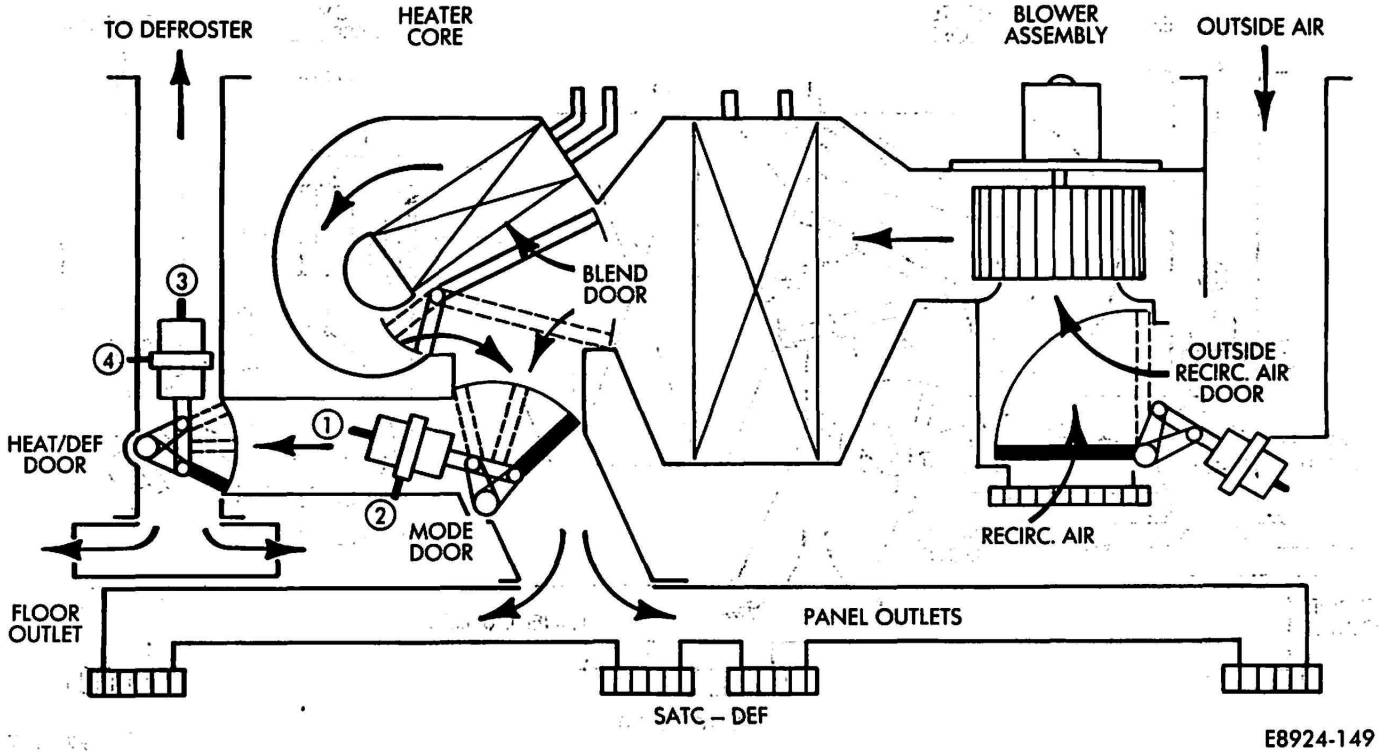


Fig. 9—Semiautomatic Control—Defrost Mode

A/C VACUUM SCHEMATIC (SATC)

Mode	Recirc	Mode 1	Mode 2	Flr/Def 3	Flr/Def 4	Airmix
OFF	Recirc (NV)	Flr/Def (NV)	Flr/Def (NV)	Def (NV)	Def (NV)	Auto Set
MAX A/C	Recirc (V)	Panel (V)	Panel (V)	Floor (V)	Floor (V)	Auto Set
NORM A/C	Outside (NV)	Panel (V)	Panel (V)	Floor (V)	Floor (V)	Auto Set
B/L	Outside (NV)	Mix (V)	Mix (NV)	Floor (V)	Floor (V)	Auto Set
VENT	Outside (NV)	Panel (V)	Panel (V)	Floor (V)	Floor (V)	Auto Set
HEAT	Outside (NV)	Flr/Def (NV)	Flr/Def (NV)	Floor (V)	Floor (V)	Auto Set
HT/DEF	Outside (NV)	Flr/Def (NV)	Flr/Def (NV)	Mix (V)	Mix (NV)	Auto Set
DEF	Outside (NV)	Flr/Def (NV)	Flr/Def (NV)	Def (NV)	Def (NV)	Auto Set

V Vacuum applied by solenoid (solenoid open)
NV No vacuum applied (solenoid closed)
Flr Floor

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ELECTRICAL DIAGNOSTICS

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GENERAL INFORMATION

When either the select switch or blower speed switch or the rear and front defrost push buttons are operated, voltage signals are transmitted to the air control module (ACM). This determines the air door position for the new mode and transmits serial data to the climate display module so that it will advance the display to the new selection.

If the select switch is held depressed for longer than one second, the mode indication advances again in the same direction. It will continue advancing once every half-second until either the select switch is released or the last available mode in that direction is reached. The ACM then waits for one second and begins operation in the new mode.

The ACM determines blower speed according to the selection set by the operator.

The relays provide a ground for the blower motor either directly or through part of the blower resistor block. If none of the relays are operated there is no path to ground and the blower does not run. For high speed operation, the ACM grounds the terminal A3 to operate the HI speed relay. The HI speed relay contacts ground to the blower motor which then receives full battery voltage and runs at maximum speed. For low speed operation, both the M1 speed and M2 speed relays are operated. Current through the blower motor bypasses the normally closed contacts of the HI speed relay, and passes through the 0.17 ohm resistance in the blower resistor block, the closed contacts of the M2 speed relay and the remainder of the blower resistor block to ground. The resistor block limits the current so that the blower motor runs at low speed. Intermediate speeds are obtained by operation of either the M2 speed relay or the M1 speed relay. Each relay, when energized, connects a shunt across one of the resistors in the blower resistor block.

Temperature is selected by sliding the temperature selector. The potentiometer output voltage varies with the setting. The voltage is transmitted to the ACM. The ACM then operates the air mixture door control to position the door according to the new setting. The potentiometer in the air mixture door control moves with the door and provides position indication to the program circuits in the ACM.

The ACM can automatically detect the following faults in the system. When it does, the mode indicator flashes Er for about five seconds each time the ignition switch is turned ON. If the fault does not occur again for 60 ignition turn-on cycles, the condition is cleared from memory and the mode indicator no longer flashes Er. See Troubleshooting for definitions of the fault codes and the procedure for displaying them.

The current temperature setting is displayed by the climate display module. Pressing the top or bottom half of the switch immediately raises or lowers the temperature by one degree. The setting on the English/Metric switch determines whether the step change is 1°F or 1°C. If the temp switch is pressed for longer than one second, the temperature setting is advanced one degree every half-second until the switch is released or the end of the temperature range is reached. The temperature range extends from (18°C) 65°F to (29°C) 85°F. Two additional settings at (10°C) 60°F and (32°C) 90°F are used for maximum cooling or maximum heat when checking the system operation.

The temperature display is advanced by serial data transmitted to the climate display.

The ACM maintains the selected temperature inside by reading the in car and outside temperature sensors and positioning the air mixture door. The sensor consists of resistors which vary inversely with the temperature. A small current flowing through the sensors generates a voltage drop. The amount of this voltage drop varies according to the resistance of sensor and provides an input to the ACM. The ACM positions the air mixture door so that the interior car temperature reaches the level set by the operator in the shortest period of time possible.

When one of the A/C modes is engaged, voltage is applied to the A/C compressor clutch when the A/C clutch relay is operated. The A/C refrigerant pressure is monitored by the A/C low pressure cut out switch. When the pressure drops to 25 psi the switch opens, removing ground from terminal C8 of the ACM. The ACM then de-energizes the A/C clutch relay. The A/C compressor clutch is disengaged until the A/C low pressure cut out switch closes again. This causes the A/C compressor to cycle on and off so that the temperature of the evaporator does not drop low enough to cause it to freeze.

There are three lines between the ACM and the electronic control unit (ECU) to provide an interface between the two modules.

1. The A/C predict output from the ACM rises to battery voltage about 0.5 seconds before the ACM energizes the A/C clutch relay. The ECU then increases the engine idle speed before the A/C compressor clutch is engaged. When the A/C compressor clutch is disengaged, the A/C predict output returns to 0 volts to signal the ECU that engine idle speed can be returned to normal.

2. The A/C select output from the ACM is at battery voltage whenever the system is operating in the MAX, NORM, BI-LEV, HEAT/DEF or DEFROST modes. It remains at battery voltage even though the A/C compressor clutch is cycled ON and OFF. During operation in the HEAT or VENT modes, the A/C select output is at ground.

3. The A/C cut out output from the ECU is at battery voltage when the engine is under a heavy load condition (full throttle) or the engine is cold. This voltage signals the ACM to disengage the A/C compressor clutch during heavy engine load or to keep the blower motor turned off when starting or in HEAT or HEAT/DEF modes and the engine has not yet heated up.

DIAGNOSTIC PROCEDURES

(Heater Only or SATC)

Diagnostic Chart

CHART NUMBER	SYMPTOM
1	When the ignition is turned to RUN, the mode indicator (with heater only) or Er (with heater-A/C) flashes for 5 seconds
2	No heating or air conditioning at all
3	Heating or air conditioning operates correctly, but climate display is inoperative
4	Control keys do not operate correctly
5	Blower motor does not operate correctly
6	A/C compressor clutch does not engage

1. On-Board Diagnostic Tests

The On-Board Diagnostic Tests consist of four individual diagnostic modes. The modes are LOW, M1, M2 and HI. The mode is selected by using the blower speed button and are displayed on the blower speed segments of the display. While in a diagnostic mode, the air distribution system will continue operating at the conditions set prior to entering the on-board diagnostics. When the mode indicator lights show a fault, the fault is present now or has occurred at any time during the last 60 turns of the ignition. Any corrected faults can be erased by pressing the FRONT DEFROST button for five seconds. During this five second interval, the illuminated fault segment will flash, warning that a fault clear attempt is about to occur.

Low Mode

After five seconds, all cleared fault segments will be turned off. If a system fault is still present, the fault will not be erased, the segment will stay on, and it will stop flashing.

To begin the on-board diagnostics, press the blower speed select up, mode select left, and front defrost buttons at the same time for three consecutive seconds. When all segments on the display are lit, release the buttons. You have now entered the low mode. Now observe which mode select segments are lit and perform the corresponding action.

When problem is fixed, cycle the ignition switch from OFF to RUN. Re-enter the on-board diagnostics. Erase the fault from memory. If the indicator does not go out, the problem is not fixed. To exit the diagnostic mode, hold down the blower speed select up, mode select left and front defrost buttons at the same time.

SEGMENT LIT	ACTION
OFF	None of the seven faults are now present or stored in memory. Press the blower speed select up button once, go to the M1 mode chart.
BI/LEV	Check wires to terminals 5 and 6 at air mixture door control for opens. If wires are ok, and no other indicators are lit, replace air mixture door control.
VENT	Airmix door travel range too small. Go to M2 mode chart.
HEAT	Airmix door travel range too large. Go to M2 mode chart.
HEAT/DEF	Check terminals 9 and 10 at air mixture door control for 5 volts. If ok, replace air mixture door control.
DEF	Check wire to terminal 9 of air mixture door control for a short to ground. If ok, replace air mixture door control.
MAX (A/C only)	Repair open in wires to terminals C13 and D5 (outside temp. sensor) of the ACM. If ok, replace outside temp. sensor.
NORM (A/C only)	Repair short to ground in wire to terminal C13 of the ACM. If ok, replace outside temp. sensor.

M1 Mode

The set temperature digits display the A/C clutch status while in this mode:

SEGMENT LIT	ACTION
OFF	No faults are currently found by the on-board diagnostics
HEAT/DEF (heater only)	Repair open in wire to terminal E12 (temp. select potentiometer) of the Air Control Module
DEF (heater only)	Repair short to ground in wire to terminal E12 (temp. select potentiometer) of the Air Control Module
MAX (A/C only)	Repair open in wires to in car temp. sensor. If ok, replace the in car temp. sensor
NORM (A/C only)	Repair short to ground in wires to in car temp. sensor. If ok, replace the in car temp. sensor

DISPLAY	MEANING	CLUTCH STATUS
ON	A/C clutch ON	ON
OP	Open A/C low pressure cut out switch	OFF
HL	Heavy load	OFF
NC	No clutch (OFF, VENT or HEAT mode active)	OFF

M2 Mode

In this mode four airmix door operations can be manually selected by using the SELECT button. The operations are:

BI/LEV—The airmix door is positioned in response to the automatic temperature algorithm or manual temperature potentiometer. The set temperature digits display the current voltage on the airmix door feedback wire in tenths of volts, ±0.3 volts.

VENT—The airmix door is moved toward the full hot position. The motor will stop when the door has stopped against the full hot stop or a position 45 degrees from center-of-travel has been reached. While the door is moving and for up to five seconds after the door has stopped, the air control selection buttons are de-activated. The VENT mode segment flashes at a 2 Hz rate while the motor is driven. The set-temperature digits display the current voltage on the airmix door feedback wire in tenths of volts, ±0.3 volts.

HEAT—The airmix door is moved toward the full-cold position. The motor will stop when the door has stopped against the full cold stop or a position of 45 degrees from center-of-travel has been reached. While the door is moving and for up to five seconds after the door has stopped, the air control selection buttons are de-activated. The HEAT mode segment flashes at a 2 Hz rate while the motor is driven. The set-temperature digits display the current voltage on the airmix door feedback wire in tenths of volts, ±0.3 volts.

HEAT/DEF—The airmix door is positioned in response to the automatic temperature algorithm. The set temperature digits display the range of airmix door travel as determined during the pre-

vious two modes, in degrees (±3 degrees).

If the feedback wire for airmix door is open or shorted to ground, the airmix door will not move, none of the four modes can be entered (the mode segments are blank) and the set temperature digits will display ?.

High Mode

Both temperature sensor inputs can be read on the display by using the SELECT button to manually select one of the following:

NORM—Outside Temperature (°F)

BI/LEV—In car Temperature (°F)

The temperature is displayed as follows: the display range for the outside temperature reading is –40°F through 140°F and –40°F through 185°F for the in car sensor. If a sensor line is open or shorted to ground, the set temperature digits will display ? when the sensor is selected.

TEMPERATURE IN °F	SET TEMPERATURE DISPLAY	SEGMENT "OFF" INDICATOR
Temperature below 0°F	Flashing Temperature	OFF
0°F through 99°F	Temperature displayed	OFF
Temperature above 100°F	Temperature displayed	ON

2. No Heating or Air Conditioning At All: Ignition Switch In RUN

TEST	OK
Check Fuse 2	Not blown
Air Control Module connector - Terminal D13	Battery voltage
Air Control Module connector - Terminal D3	Battery voltage
Air Control Module connector - Terminal D3 to Terminal D7	Battery voltage
Control Switch module connector - Terminal E3	5 volts

3. Climate Display Is Inoperative: Ignition Switch In Run

TEST	OK	NOT OK
Instrument Cluster Climate Display connector - Terminal E	Battery voltage	Repair open from fuse
Instrument Cluster Climate Display connecter - Terminal E to Terminal F	Battery voltage	Repair open to I/P harness splice
Instrument Cluster Climate Display connector - Terminal E to Terminal C	Battery voltage	Repair open to ACM

*If voltages are correct, check that the wires from the climate display connector terminals A and B are not open or shorted.

4. Control Keys Or Slider Do Not Operate Correctly

Check wire between ACM and control switch module for damage and repair as necessary. If wires are ok, replace the ACM with a known good one. If the problem still exists, replace the control switch module.

5. Blower Motor Does Not Operate Correctly: Symptom Table

SYMPTOM	ACTION
Blower motor does not operate in any mode	Go to chart 5A
Blower motor only operates in HI mode	Go to chart 5B
Blower motor does not operate in M1 mode and operates at M2 in LO mode	Check wire from M1 speed relay connector - terminal 5 for an open. If ok, replace M1 speed relay
Blower motor does not operate in M2 mode and operates incorrectly in M1 or LO mode	Go to chart 5C
Blower motor does not operate in M2 mode only	Check wire from M1 Speed Relay connector - terminal 3 for an open
Blower motor does not operate in LO mode only	Check wire from Blower Resistor Block connector - terminal 5 for an open. If ok, replace blower resistor block
Blower motor does not operate in M1 and LO modes only	Check wire from M1 Speed Relay connector - terminal 4 for an open. If ok, replace blower resistor block
Blower motor does not operate at LO in M2 mode	Check wire from M1 Speed Relay connector - terminal 5 for a short to ground. If ok, replace M1 speed relay
Blower motor does not operate at LO in M1 mode	Go to chart 5D
Blower motor always runs or other symptoms	Check for shorts to ground

5A. Blower Motor Does Not Operate In Any Mode: Ignition switch in RUN, blower in HI, connectors disconnected only when testing

TEST	OK	NOT OK
Blower motor Connector A - Terminal S	Battery voltage	Repair open from Fuse Link
Blower motor Connector A - Terminal S to blower motor Connector B terminal S	Battery voltage If ok, replace blower motor	Check for open to Hi speed relay connector terminal 1 If ok, continue test
Hi speed relay connector - Terminal 2	Battery voltage	Check for open to ACM connector terminal A12 If ok, replace ACM
Hi speed relay connector - Terminal 2 to terminal 5	Battery voltage	Check for open to ACM connector terminal A3 If ok, replace ACM
Hi speed relay connector - Terminal 1 to terminal 4	Battery voltage If ok, replace the HI speed relay	Repair open to ground

5B. Blower Motor Only Operates In HI Mode: Ignition switch in RUN, blower speed at M1, connectors disconnected only when testing

TEST	OK	NOT OK
Blower resistor block connector - Terminal 1	Battery voltage	Repair open to Hi speed relay connector terminal 1
M1 speed relay connector - Terminal 2	Battery voltage	Repair open to Hi speed relay connector terminal 2
M1 speed relay connector - Terminal 1	Battery voltage If ok, replace M1 speed relay	Check for open to blower resistor block connector terminal 2 If ok, replace blower resistor block
M2 speed relay connector - Terminal 1	Battery voltage	Check circuits attached to terminals 3 and 4 of blower resistor block for an open. If wires are good, replace the blower resistor block
M2 speed relay connector - Terminal 1 to Terminal 3	Battery voltage If ok, replace M2 speed relay	Check wire at terminal 3 of M2 speed relay for an open

5C. Blower Motor Does Not Operate In M2 Mode And Operates Incorrectly In M1 or Lo Mode: Ignition switch in RUN, blower speed at M2 connector disconnected

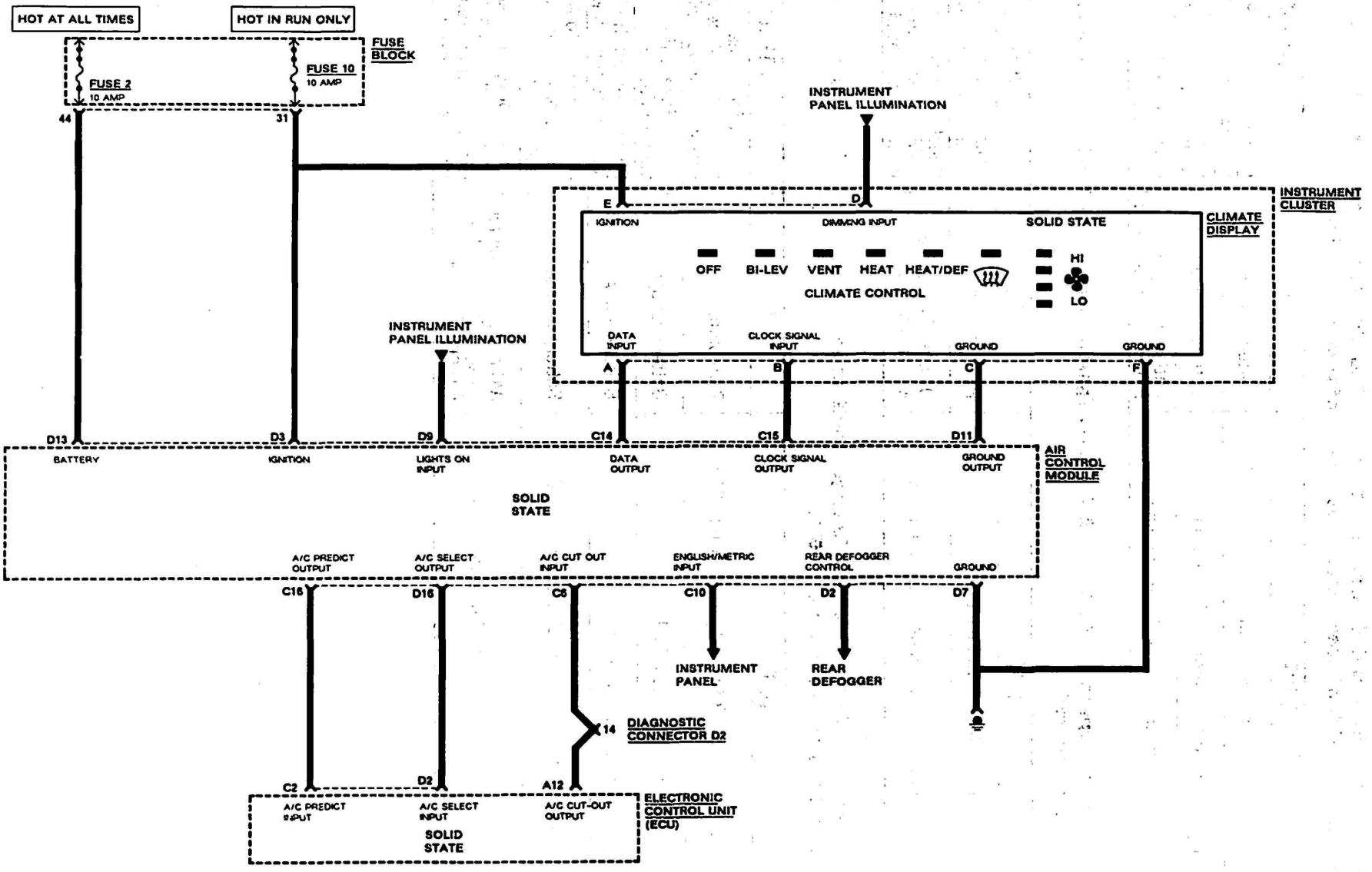
TEST	OK	NOT OK
M2 speed relay connector - Terminal 2	Battery voltage	Repair open to M1 speed relay connector terminal 2
M2 speed relay connector - Terminal 2 to terminal 5	Battery voltage	Check for open ACM connector terminal A1 If ok, replace ACM
M2 speed relay connector - Terminal 2 to terminal 3	Battery voltage If ok, replace M2 speed relay	Check for open in harness to splice

5D. Blower Motor Operates At LO in M1 Mode: Ignition switch in RUN, blower speed at M1 connector disconnected

TEST	OK	NOT OK
M2 speed relay connector - Terminal 1	Battery voltage	Repair open to Blower resistor block connector terminal 4
M2 speed relay connector - Terminal 2 to terminal 5	0 volts If ok, replace M2 speed relay	Check for a short to ground at ACM connector terminal A1 If ok, replace ACM

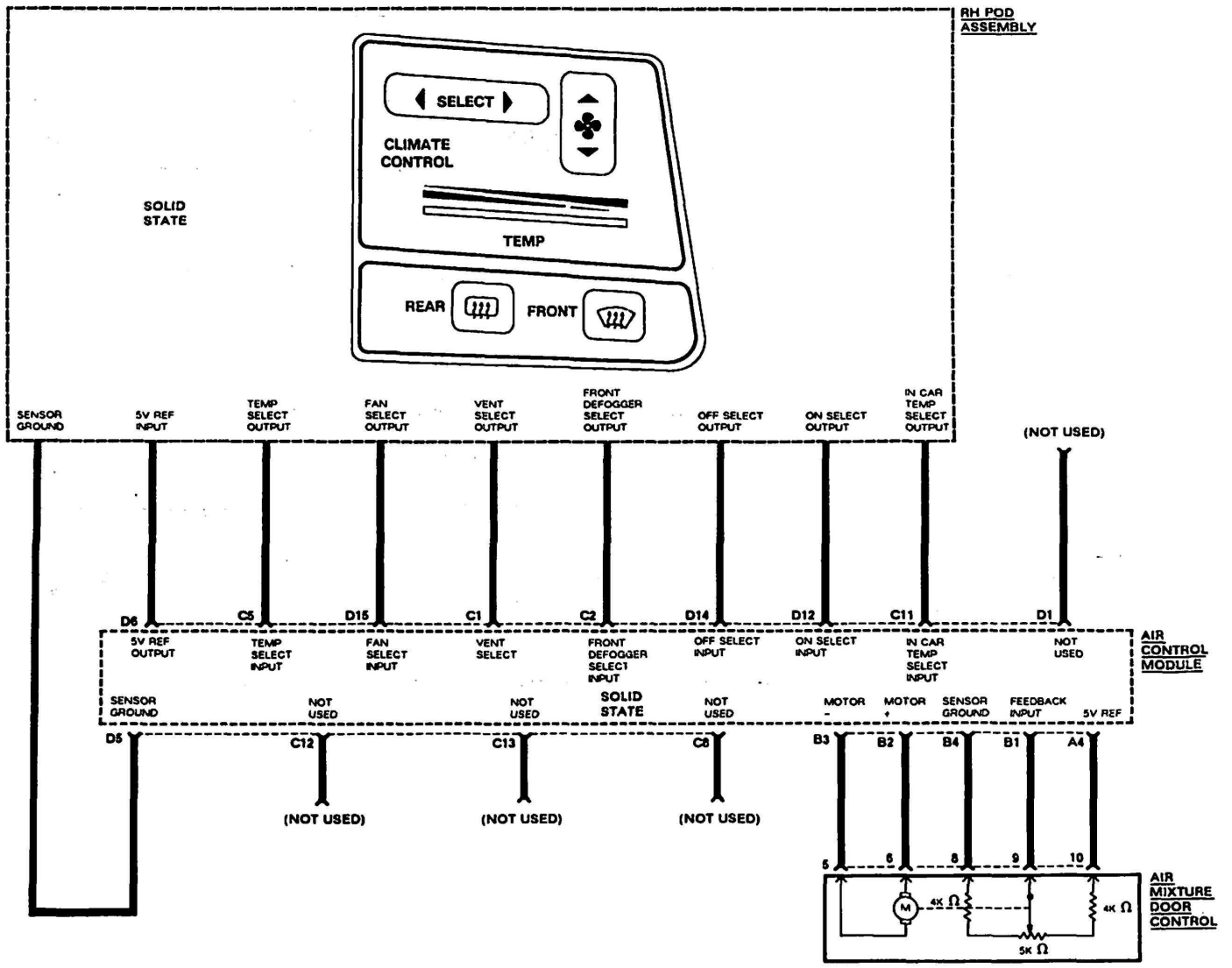
6. A/C Compressor Clutch Does Not Engage: Ignition switch in RUN, climate control in NORM, climate control temperature setting 65°F.

TEST	OK	NOT OK
ACM connector terminal C8 to D5 Ignition switch OFF	Zero ohms	Check for normal refrigerant level If ok, replace A/C low pressure cut out switch
A/C clutch relay connector - terminal 5	Battery voltage	Check Fuse 8 If ok, check for open to Fuse 8
A/C clutch relay connector - terminal 4	Battery voltage	Check fuse link If ok, check for open to fuse link
A/C clutch relay connector - terminal 5 to terminal 2	Battery voltage	Check for open to ACM connector terminal C5 if ok, replace ACM
A/C clutch relay connector - terminal 4 to terminal 1	A/C compressor clutch engages If ok, replace A/C clutch relay	Check for open to A/C compressor clutch connector terminal S If ok, replace the air compressor clutch



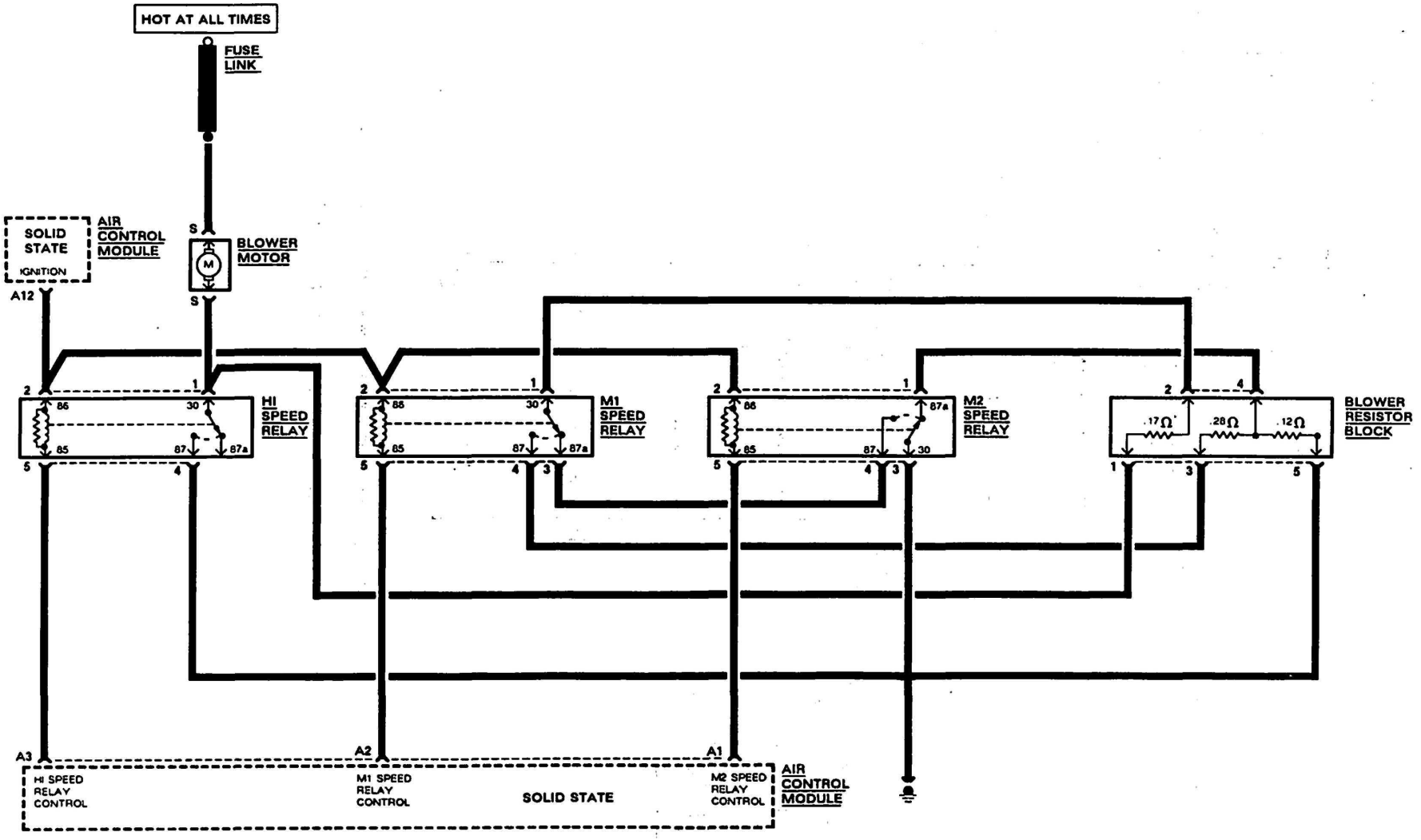
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Fig. 1—Heater Controls Climate Display Schematic



E8924-212

Fig. 2—Heater Controls Control Switch Module Schematic



RELAYS	FAN SPEED
HI SPEED	HI
M2 SPEED	•
M1 SPEED	•
M1, M2 SPEED	LO

E8924-213

Fig. 3—Heater Controls Blower Motor Resistors Schematic

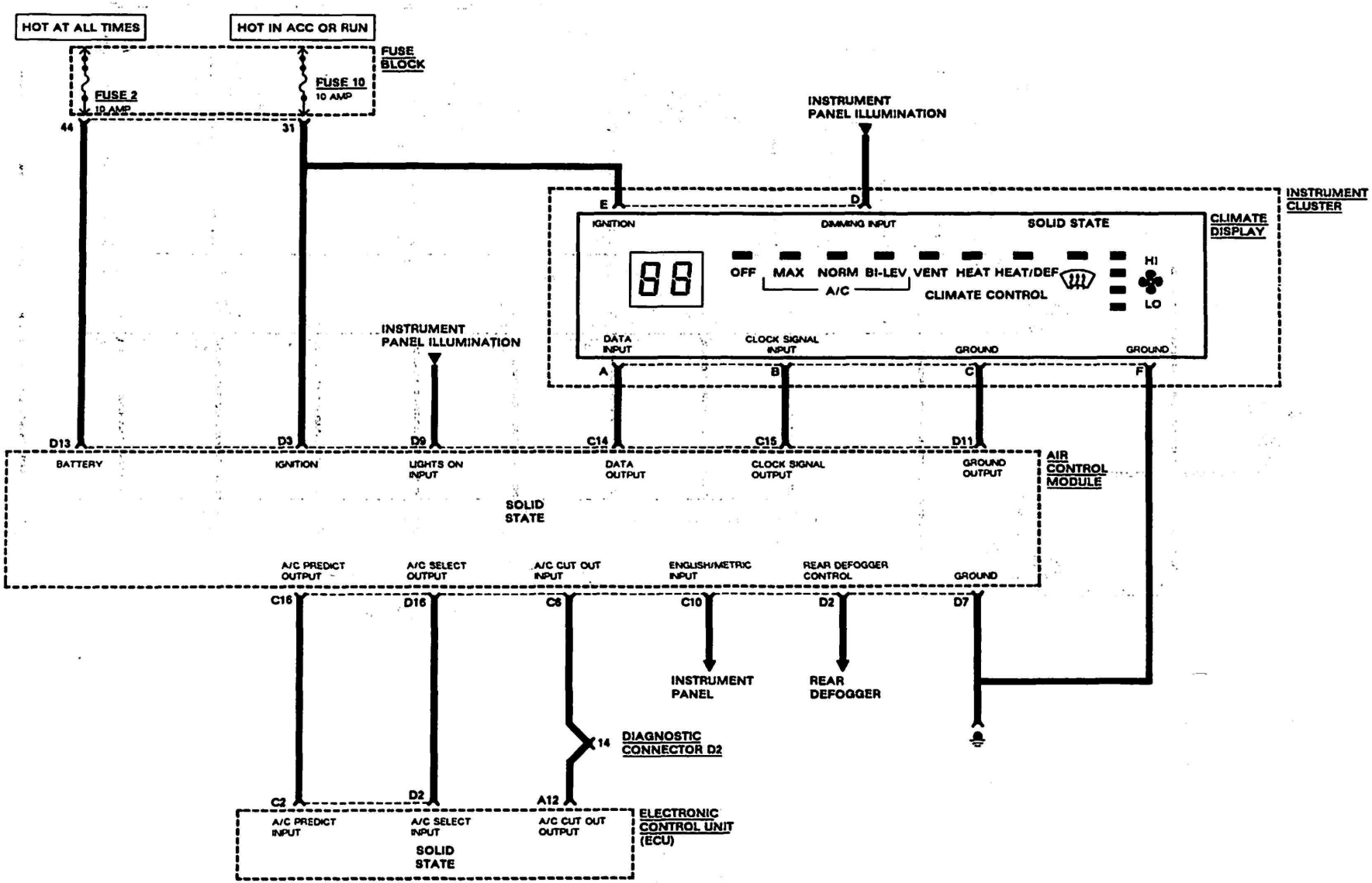


Fig. 4—Heater A/C Controls Climate Display Schematic

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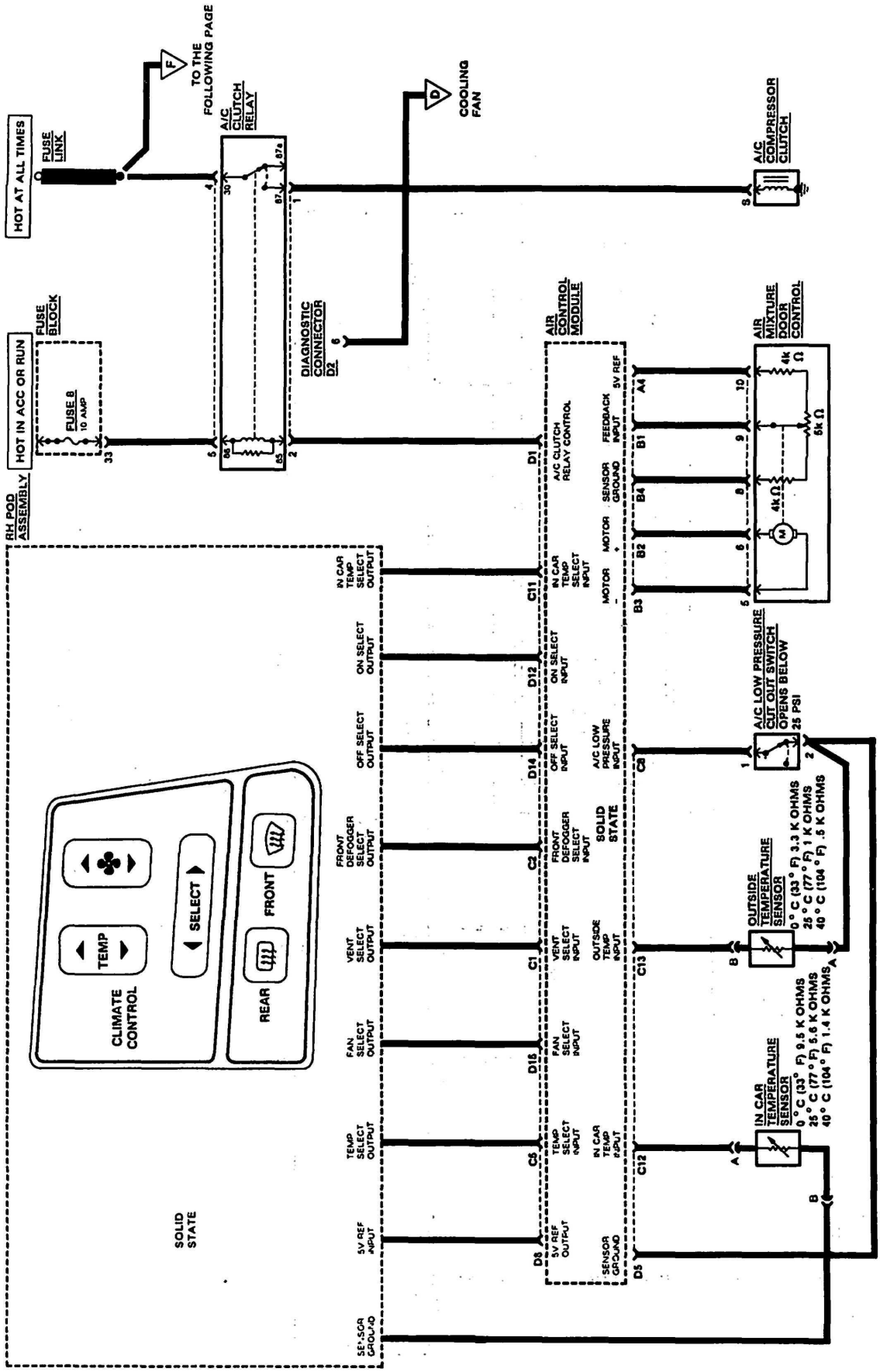
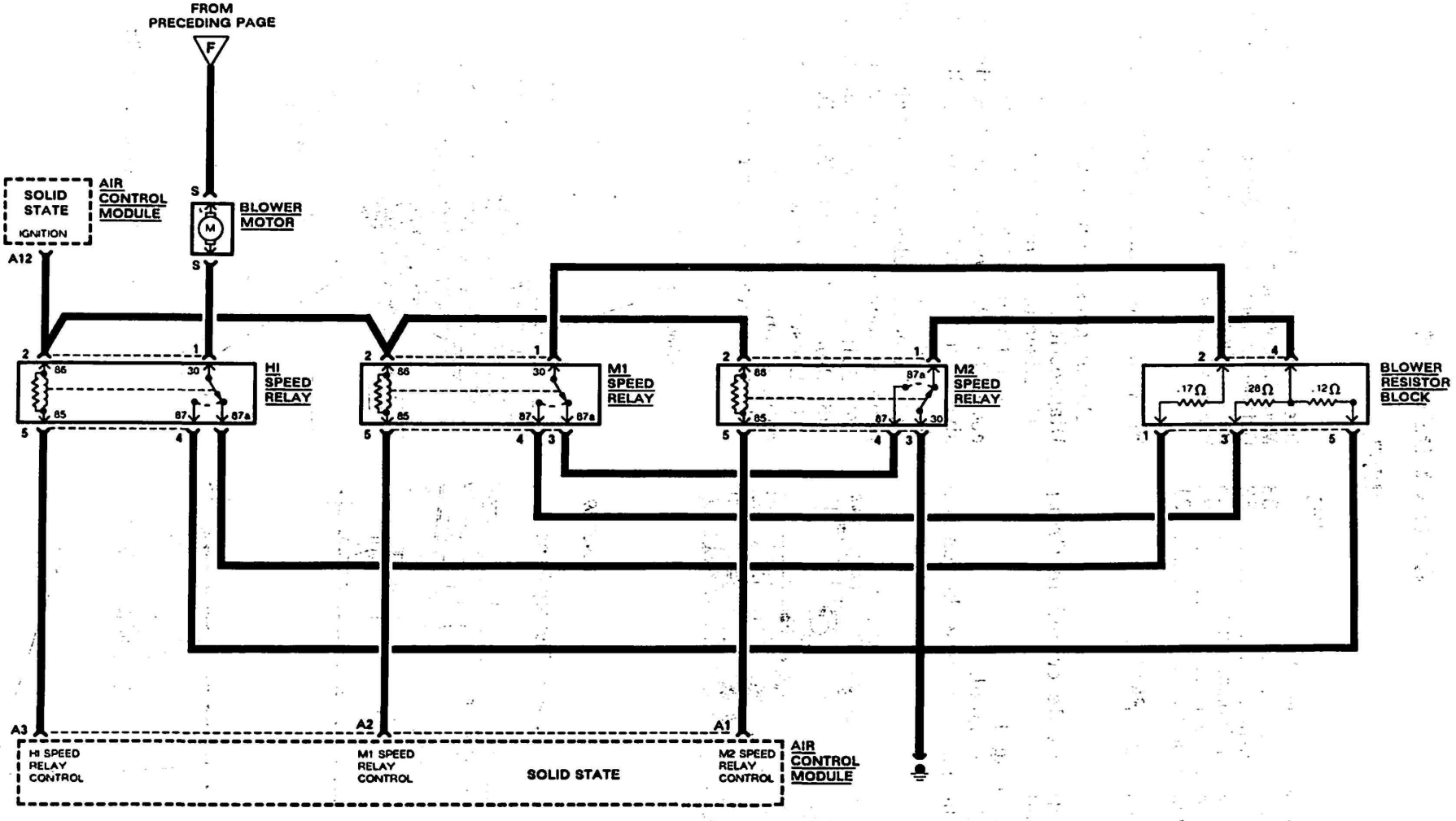


Fig. 5—Heater A/C Controls Control Switch Module Schematic



RELAYS	FAN SPEED
HI SPEED	HI
M2 SPEED	•
M1 SPEED	•
M1 AND M2 SPEED	LO

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Fig. 6—Heater A/C Controls Blower Motor Resistors Schematic

CONTROL DEVICES

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CLIMATE CONTROL DISPLAY PANEL REPLACEMENT

Remove the cluster as described in Group 8E, Instrument Panel.

(1) Remove screws (Fig. 1).

(2) Remove the display panel.

(3) To install display panel, reverse the removal procedures.

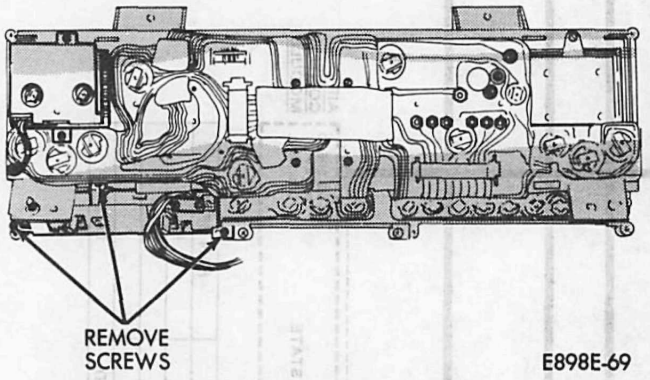


Fig. 1—Climate Control/Heater Display Panel

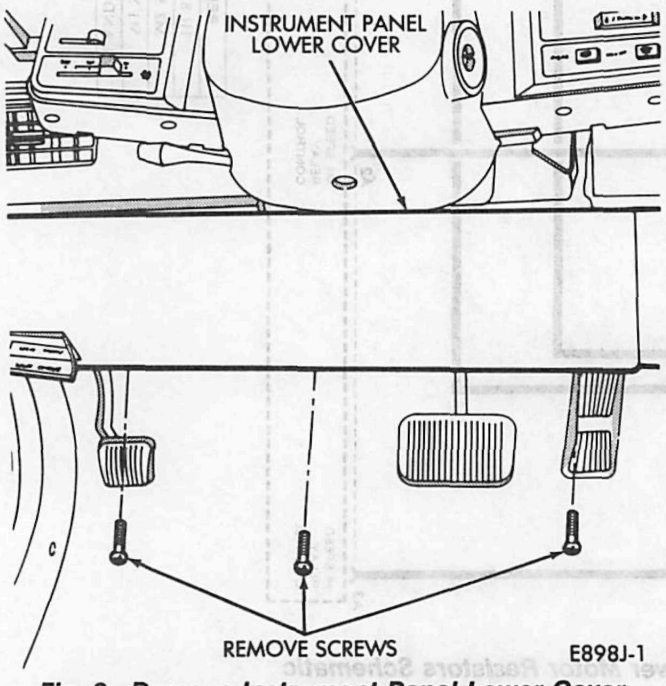


Fig. 2—Remove Instrument Panel Lower Cover

HEAT/AC CONTROL POD REPLACEMENT

For diagnostic information refer to Electrical Diagnostics.

(1) Disconnect battery negative cable.

(2) Remove screws and instrument panel lower cover (Fig. 2) if equipped. If equipped with Passive Restraint, refer to Group 8E for knee bolster removal.

(3) Remove bolts that attach the instrument panel support rod (Fig. 3) and remove the rod.

(4) Pull air duct (Fig. 3) out of the way.

(5) Remove tie straps (Fig. 4).

(6) Loosen holddown nut in center of steering column connector (Fig. 5).

(7) Separate the steering column connector.

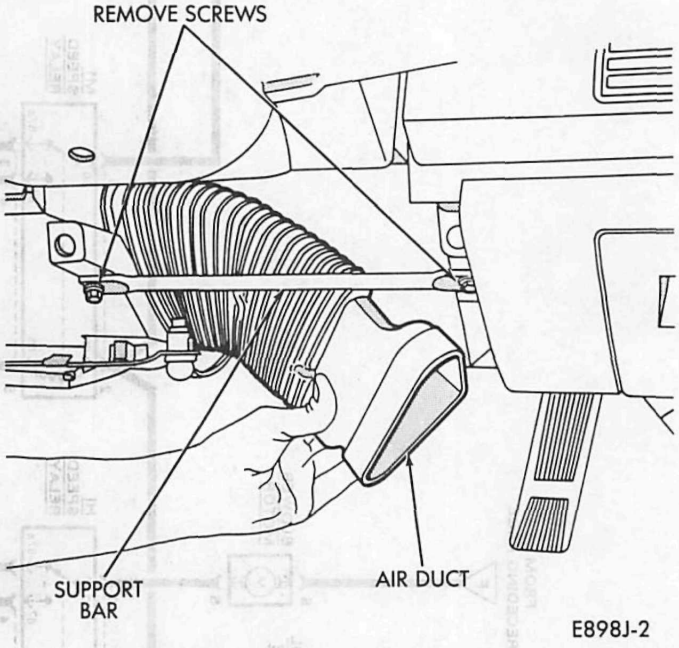


Fig. 3—Remove Support Bar

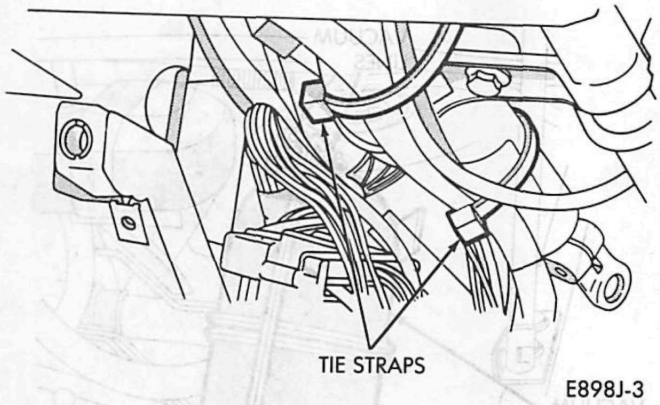


Fig. 4—Remove Tie Straps

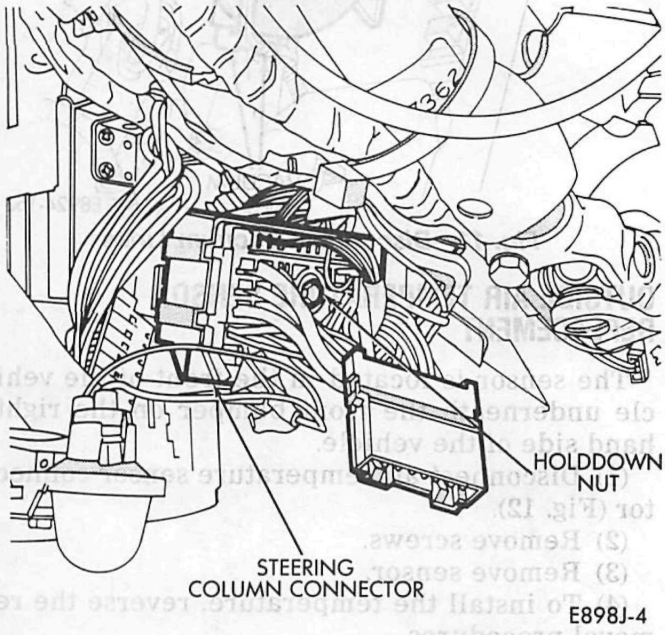


Fig. 5—Loosen Holddown Nut

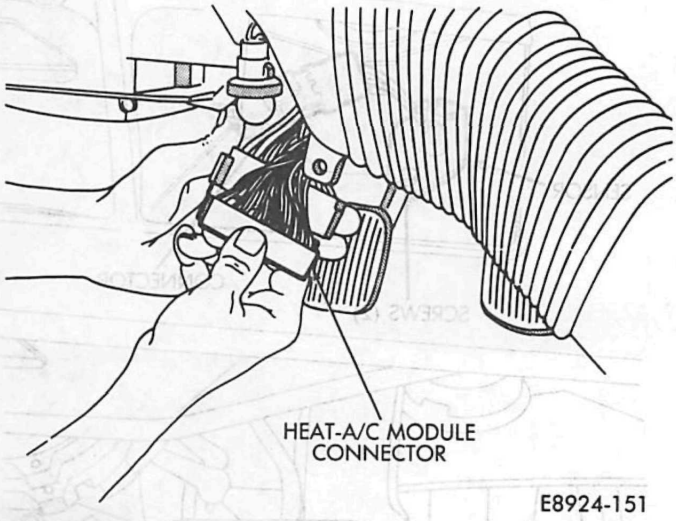


Fig. 6—Heat/AC Switch Connector

(8) Separate the heat/AC pod connector (Fig. 6) from the steering column connector by placing a flat blade screwdriver between the connectors to disengage locking tab. Push on the wire side of the heat/AC pod connector and slide the connector out of the channels of the steering column connector.

(9) Remove heat/AC pod retaining screws (Fig. 7).

(10) Remove screw holding lower column shroud (Fig. 8).

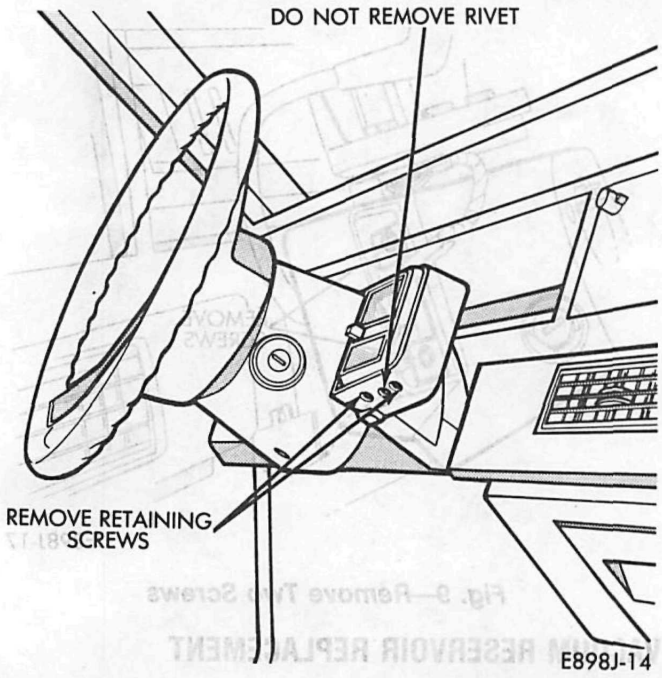


Fig. 7—Remove Heat/AC Module Retaining Screws

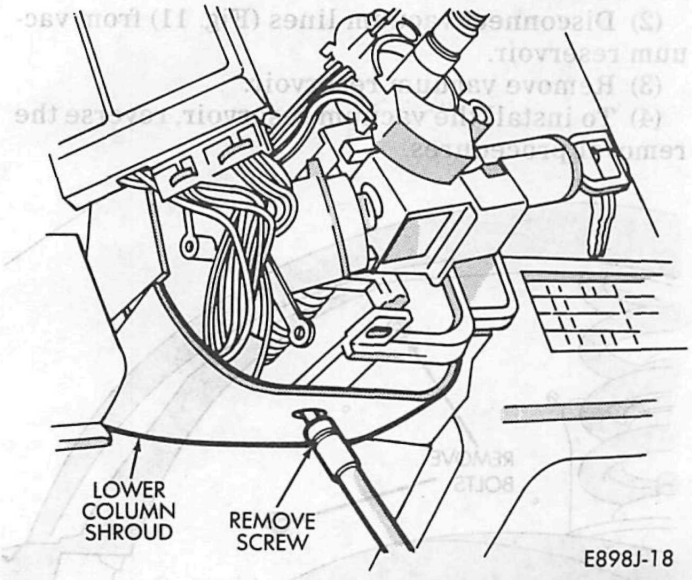


Fig. 8—Remove Lower Shroud Screw

(11) Separate and remove the lower column shroud.

(12) Gently pull pod wires out through the housing to remove the pod. It may be necessary to remove the two screws (Fig. 9) to gain enough clearance to allow the connector to be removed.

(13) To install the heat/AC module, route heat/AC module connector through the housing and along underside of steering column and reverse the removal procedures.

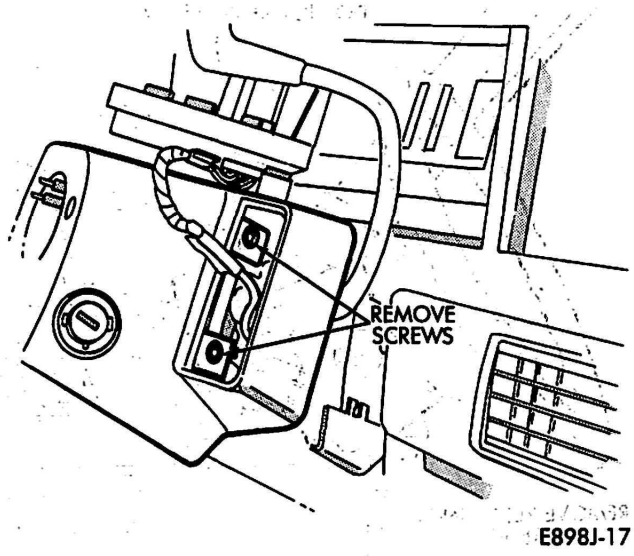


Fig. 9—Remove Two Screws

VACUUM RESERVOIR REPLACEMENT

(1) Remove mounting bolts (Fig. 10) from the inner fender wheel.

(2) Disconnect vacuum lines (Fig. 11) from vacuum reservoir.

(3) Remove vacuum reservoir.

(4) To install the vacuum reservoir, reverse the removal procedures.

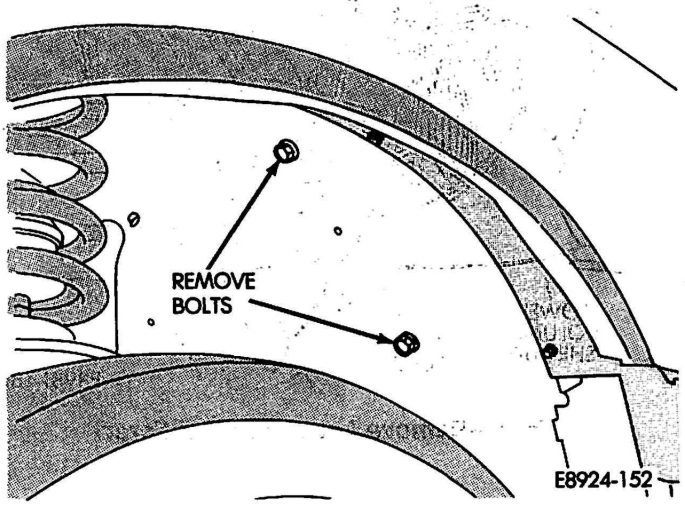


Fig. 10—Remove Reservoir Mounting Bolts

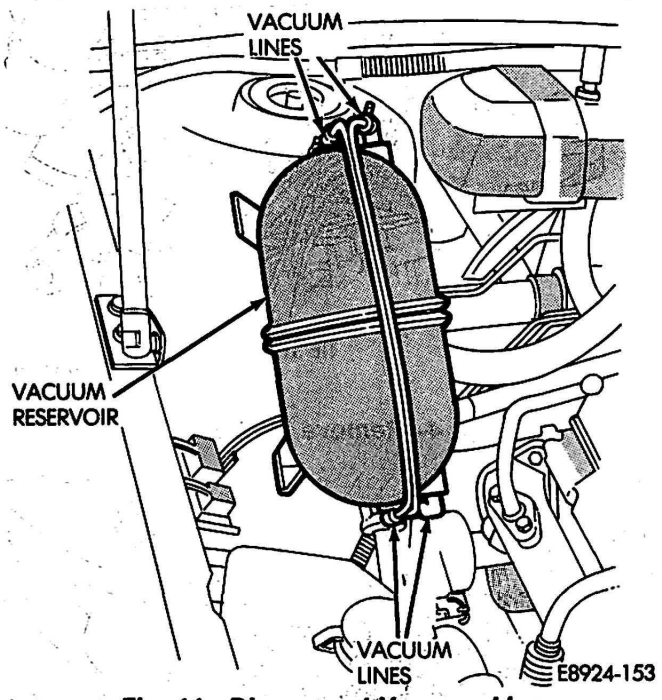


Fig. 11—Disconnect Vacuum Lines

OUTSIDE AIR TEMPERATURE SENSOR REPLACEMENT

The sensor is located in the front of the vehicle underneath the front bumper on the right-hand side of the vehicle.

(1) Disconnect air temperature sensor connector (Fig. 12).

(2) Remove screws.

(3) Remove sensor.

(4) To install the temperature, reverse the removal procedures.

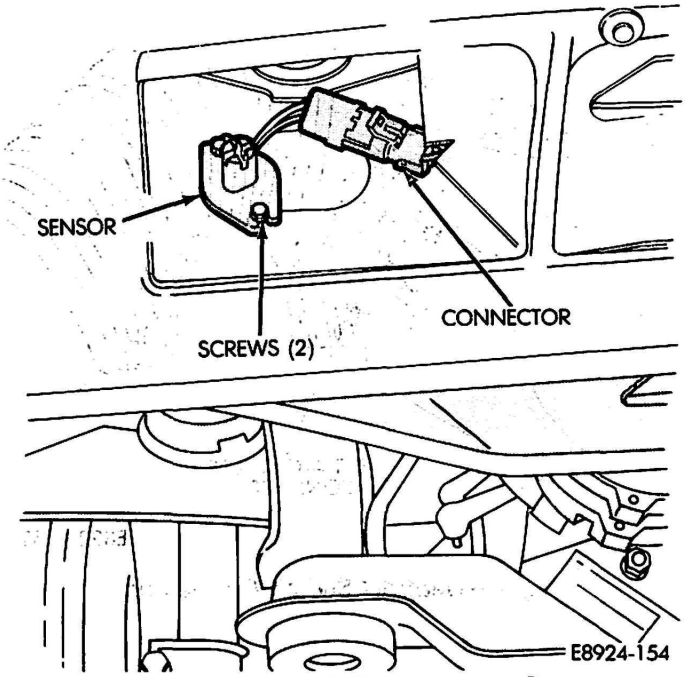


Fig. 12—Outside Air Temperature Sensor

RECIRCULATION DOOR VACUUM MOTOR

Removal

(1) Open glove box and remove screws (Fig. 13).
(2) Remove glove box liner.
(3) Reach inside glove box cavity and while disengaging locking tab (Fig. 14) remove motor arm from pivot arm.
(4) Remove spring and clear vacuum line.
(5) Twist motor in a counterclockwise direction and pull downward to remove vacuum motor from mounting bracket.

Installation

(1) Position vacuum motor to mounting bracket and press together until locking tabs snap in place.
(2) Position motor arm to pivot shaft and press together until locking tab snaps in place.
(3) Install spring and connect clear vacuum line.
(4) Install glove box liner and secure with screws.

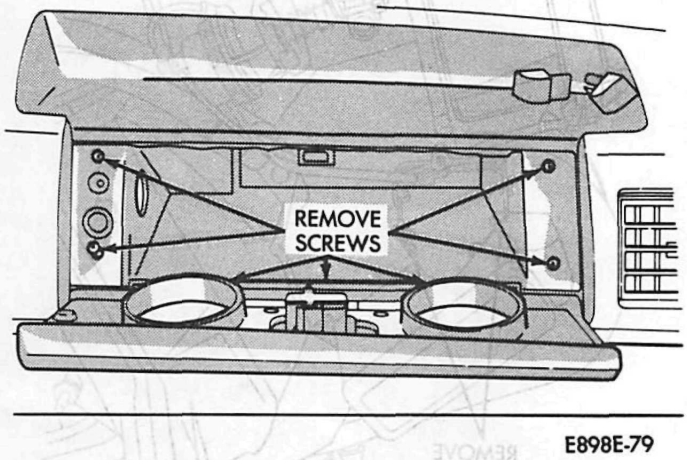


Fig. 13—Remove Glove Box Liner Screws

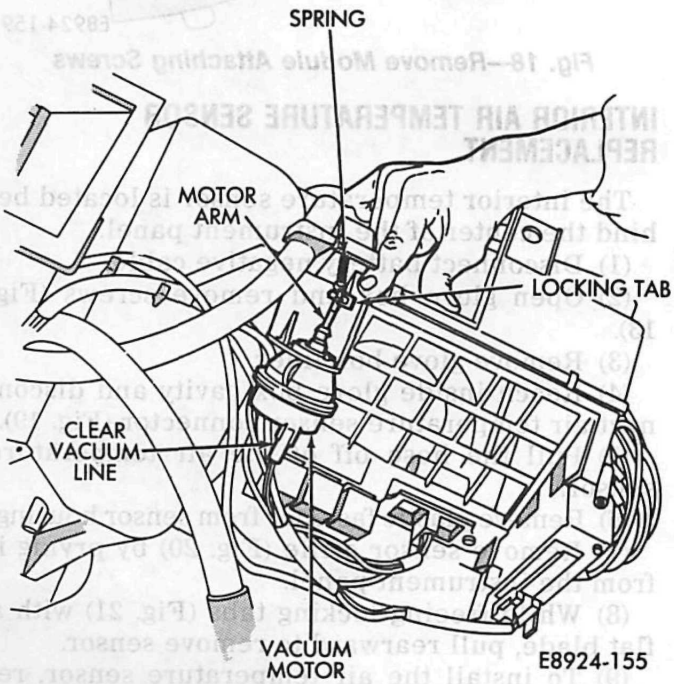


Fig. 14—Recirculation Door Vacuum Motor

MODE DOOR VACUUM MOTOR

Removal

(1) Disconnect green vacuum line (Fig. 15) and red vacuum line from motor.
(2) While disengaging locking tab, remove motor arm from pivot shaft.
(3) Remove screw.
(4) Twist motor in a counterclockwise direction and pull downward to remove vacuum motor from mounting bracket.

Installation

(1) Position vacuum motor in mounting bracket ensuring that locking tabs snap in place.
(2) Install screw.
(3) Position motor arm to pivot shaft and press together until locking tab snaps in place.
(4) Connect red vacuum line and green vacuum line to vacuum motor.

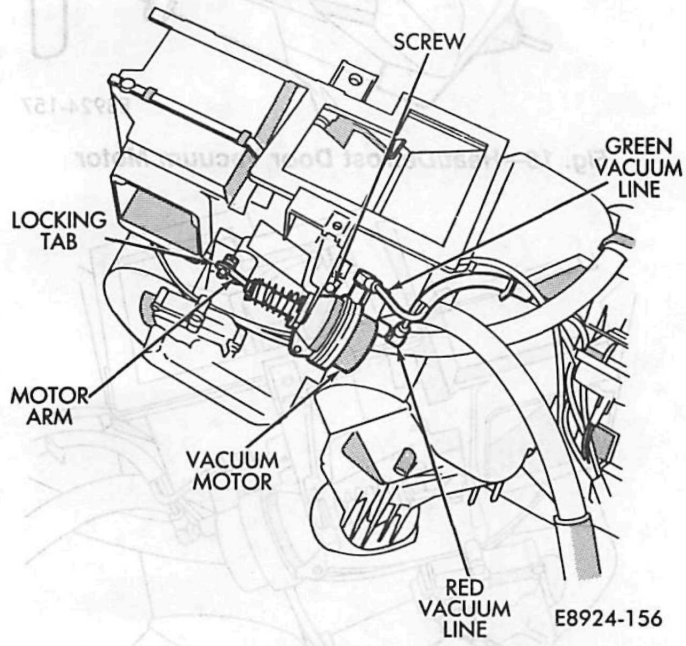


Fig. 15—Mode Door Vacuum Motor

HEAT/DEFROST DOOR VACUUM MOTOR

Removal

(1) Remove blue vacuum line (Fig. 16) and orange vacuum line from vacuum motor.
(2) While disengaging motor arm locking tab,

remove motor arm from pivot shaft.

(3) Place a flat blade against tab on motor and apply slight pressure to motor locking tab. With pressure on tab twist motor in a counterclockwise motion and pull UPWARD to remove motor.

Installation

(1) Position motor to mounting bracket. Press together until motor locking tabs snap in place.

(2) Position motor arm to pivot shaft and press together until locking tab snaps in place.

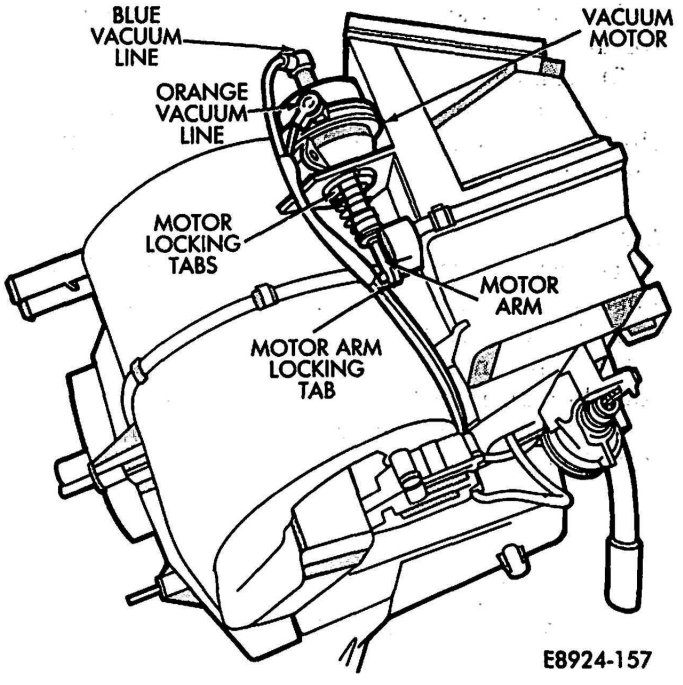


Fig. 16—Heat/Defrost Door Vacuum Motor

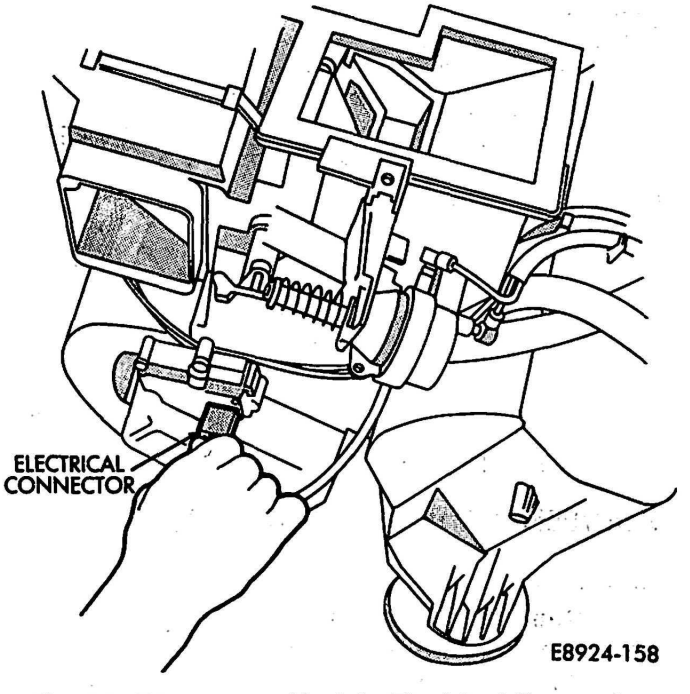


Fig. 17—Disconnect Module Electrical Connector

(3) Connect blue vacuum line and orange vacuum line to motor.

BLEND DOOR MODULE REPLACEMENT

(1) Remove center console attaching screws and slide console rearward out of the way.

(2) Remove floor duct.

(3) Move carpeting and padding aside.

(4) Remove screws (Fig. 18).

(5) Disconnect electrical connector (Fig. 17).

(6) Remove blend door module.

(7) To install the blend door module, align blend air door shaft to module drive slot and reverse the removal procedures.

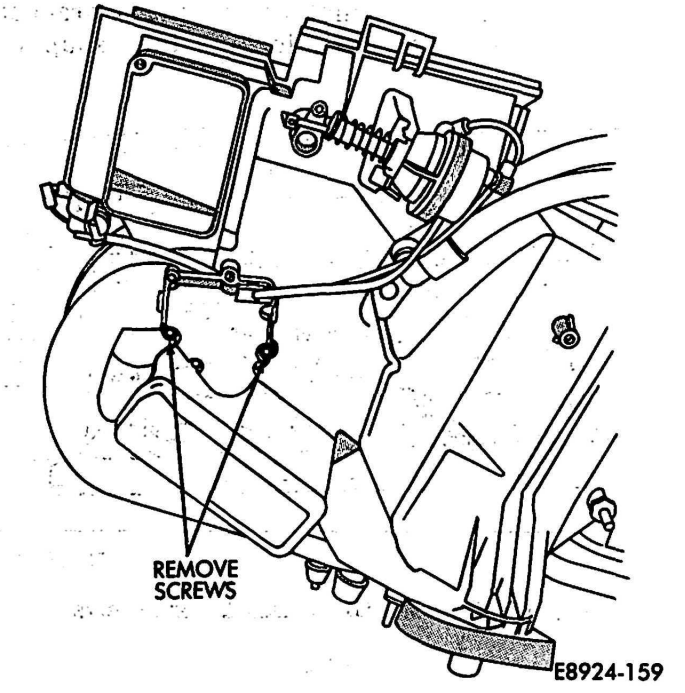


Fig. 18—Remove Module Attaching Screws

INTERIOR AIR TEMPERATURE SENSOR REPLACEMENT

The interior temperature sensor is located behind the center of the instrument panel.

(1) Disconnect battery negative cable.

(2) Open glove box and remove screws (Fig. 13).

(3) Remove glove box liner.

(4) Reach inside glove box cavity and disconnect air temperature sensor connector (Fig. 19).

(5) Pull the hose off of the air temperature sensor.

(6) Remove plastic fastener from sensor housing.

(7) Remove sensor grille (Fig. 20) by prying it from the instrument panel.

(8) While freeing locking tabs (Fig. 21) with a flat blade, pull rearward to remove sensor.

(9) To install the air temperature sensor, reverse the removal procedures.

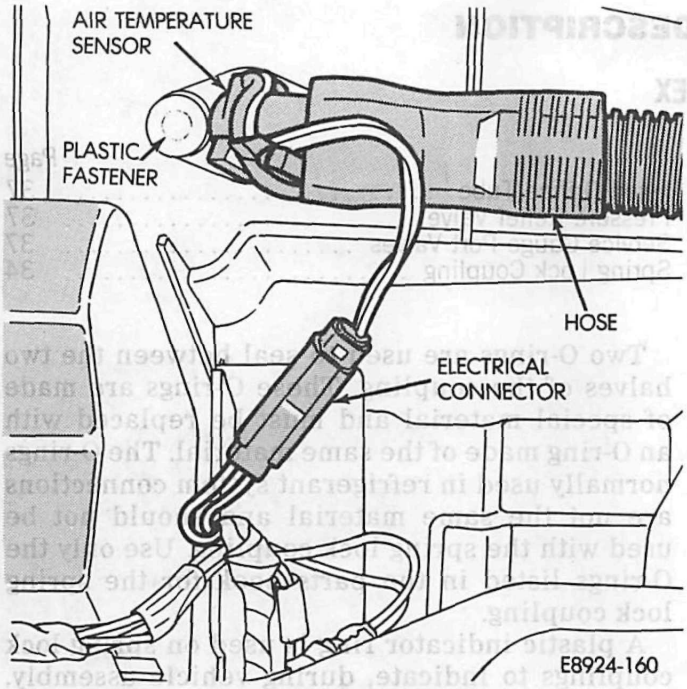


Fig. 19—Remove Hose and Disconnect Electrical Connector

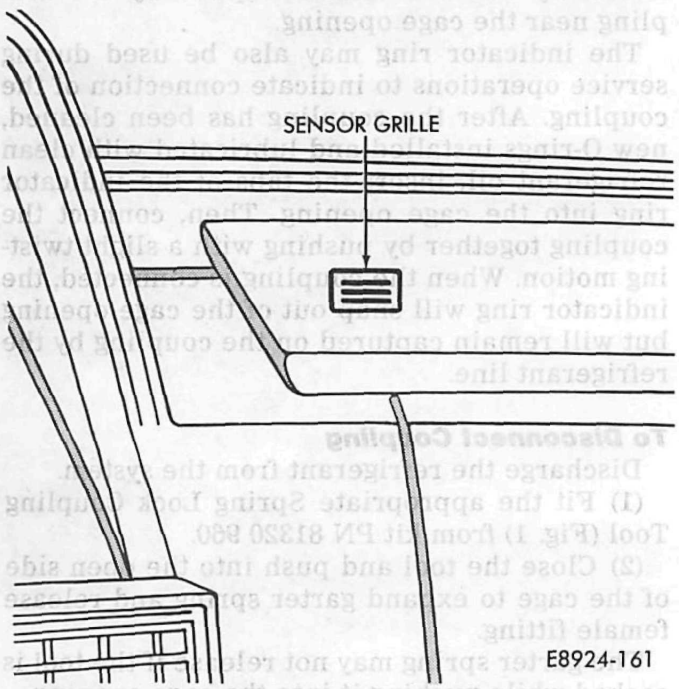


Fig. 20—Pry Sensor Grille Out

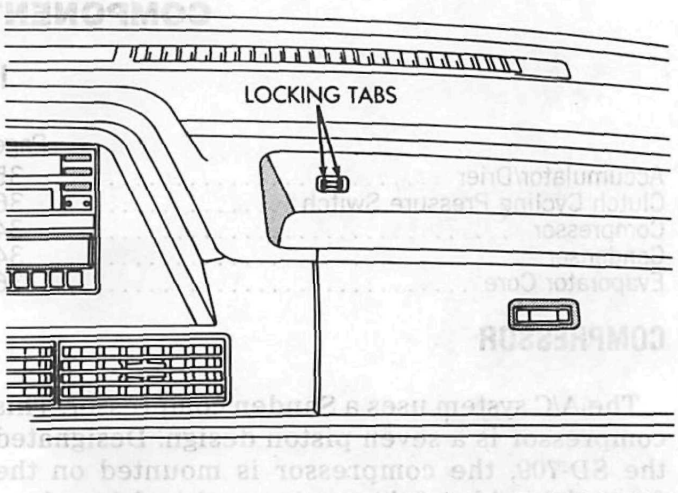


Fig. 21—Release Locking Tabs

AIR CONDITIONING CONTROL MODULE (ACM) REPLACEMENT

(1) Disconnect battery negative cable.
(2) Open glove box and remove screws (Fig. 13).
(3) Remove glove box liner.
(4) Reach inside glove box cavity and disconnect vacuum connector (Fig. 22).
(5) Disconnect electrical connectors.
(6) Remove screws.
(7) Remove ACM.
(8) To install the ACM, reverse the removal procedures.

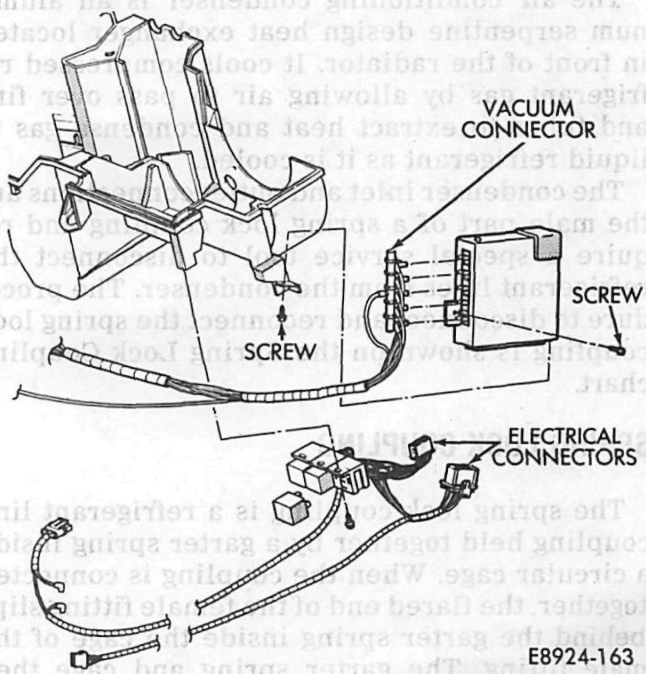


Fig. 22—ACM Removal/Installation

COMPONENT DESCRIPTION

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COMPRESSOR

The A/C system uses a Sanden compressor. This compressor is a seven piston design. Designated the SD-709, the compressor is mounted on the front right side of the engine and is driven by a serpentine drive belt. System lubrication is provided by 240cc ± 15cc of 500 viscosity refrigerant oil.

The clutch used on the compressor consists of three basic components: the pulley, front plate and the field coil. The pulley and field coil are attached to the front head of the compressor with tapered snap rings. The hub is keyed to the compressor shaft and is retained on the shaft with a self-locking nut. Special service tools are required to remove and install the clutch plate on the compressor shaft. Refer to Compressor Disassembly for compressor and clutch service procedures.

CONDENSER

The air conditioning condenser is an aluminum serpentine design heat exchanger located in front of the radiator. It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat and condense gas to liquid refrigerant as it is cooled.

The condenser inlet and outlet connections are the male part of a spring lock coupling and require a special service tool to disconnect the refrigerant lines from the condenser. The procedure to disconnect and reconnect the spring lock coupling is shown on the Spring Lock Coupling chart.

SPRING LOCK COUPLING

The spring lock coupling is a refrigerant line coupling held together by a garter spring inside a circular cage. When the coupling is connected together, the flared end of the female fitting slips behind the garter spring inside the cage of the male fitting. The garter spring and cage then prevent the flared end of the female fitting from pulling out of the cage.

Two O-rings are used to seal between the two halves of the coupling. These O-rings are made of special material and must be replaced with an O-ring made of the same material. The O-rings normally used in refrigerant system connections are not the same material and should not be used with the spring lock coupling. Use only the O-rings listed in the parts book for the spring lock coupling.

A plastic indicator ring is used on spring lock couplings to indicate, during vehicle assembly, that the coupling is connected. Once the coupling is connected, the indicator ring is no longer necessary but will remain captive by the coupling near the cage opening.

The indicator ring may also be used during service operations to indicate connection of the coupling. After the coupling has been cleaned, new O-rings installed and lubricated with clean refrigerant oil, insert the tabs of the indicator ring into the cage opening. Then, connect the coupling together by pushing with a slight twisting motion. When the coupling is connected, the indicator ring will snap out of the cage opening but will remain captured on the coupling by the refrigerant line.

To Disconnect Coupling

Discharge the refrigerant from the system.

(1) Fit the appropriate Spring Lock Coupling Tool (Fig. 1) from kit PN *81320 960.*

(2) Close the tool and push into the open side of the cage to expand garter spring and release female fitting.

The garter spring may not release if the tool is cocked while pushing it into the cage opening.

(3) After garter spring is expanded, pull fittings apart within the tool.

(4) Remove the tool from the disconnected coupling.

(5) Separate the two ends of the coupling.

To Connect Coupling

(1) Check to ensure that the garter spring is in the cage of the male fitting. If the garter spring is missing, install a new spring by pushing it into the cage opening. If the garter spring is dam-

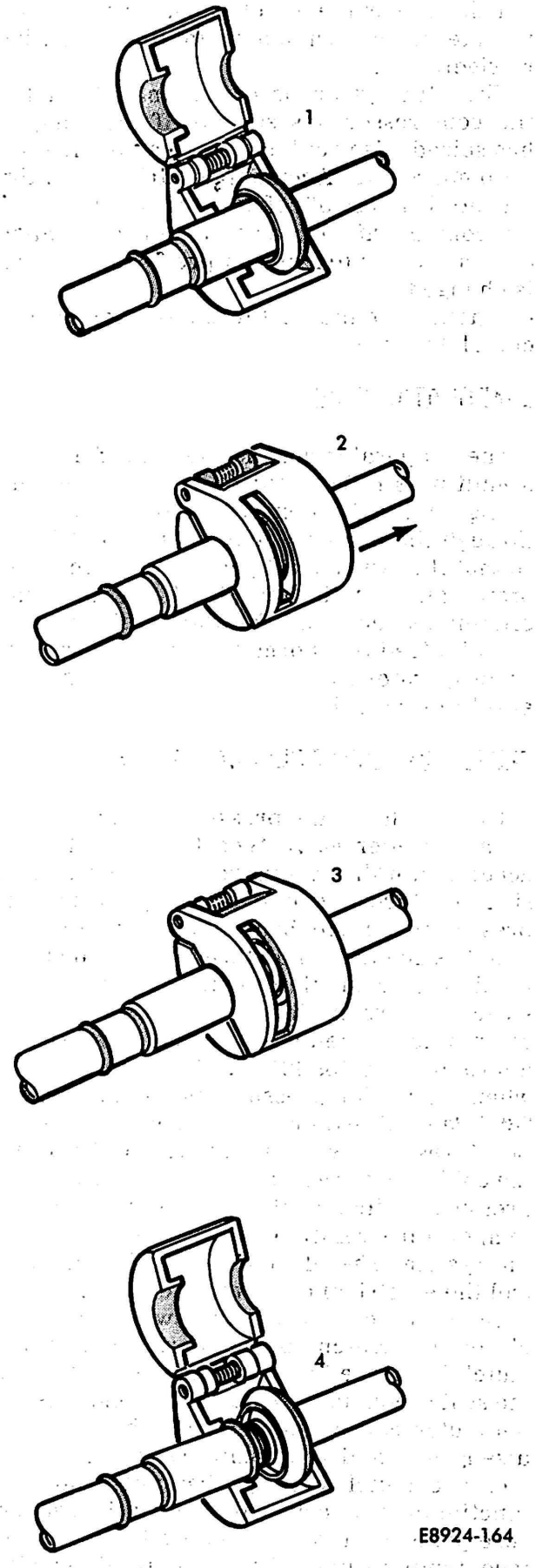


Fig. 1—Spring Lock Coupling Disconnect

aged, remove it from the cage with a small wire hook (do not use a screwdriver) and install a new spring.

(2) Clean all dirt or foreign material from both pieces of the coupling.

(3) Install new O-rings on the male fitting.

CAUTION: Use only the specified O-rings as they are made of a special material. The use of any O-ring other than the specified O-ring may allow the connection to leak intermittently during vehicle operation.

(4) Lubricate the male fitting and O-rings and the inside of the female fitting with clean refrigerant oil.

(5) Install the plastic indicator ring into the cage opening if indicator ring is to be used.

(6) Fit female fitting to male fitting and push until garter spring snaps over flared end of female fitting.

If plastic indicator ring is used, it will snap out of the cage opening when the coupling is connected to indicate engagement.

(7) If indicator ring is not used, ensure coupling engagement by visually checking to be sure garter spring is over flared end of female fitting.

ACCUMULATOR/DRIER

The accumulator/drier (Fig. 2) is mounted in the engine compartment on the right side of the vehicle. The inlet tube of the accumulator/drier attaches directly to the evaporator core outlet tube. Refrigerant enters the accumulator/drier canister through the inlet tube and the liquid oil-laden refrigerant falls to the bottom of the canister which acts as a separator allowing refrigerant to enter the compressor suction line.

A desiccant bag is mounted inside the suction accumulator/drier canister to absorb any moisture which may be in the refrigerant system.

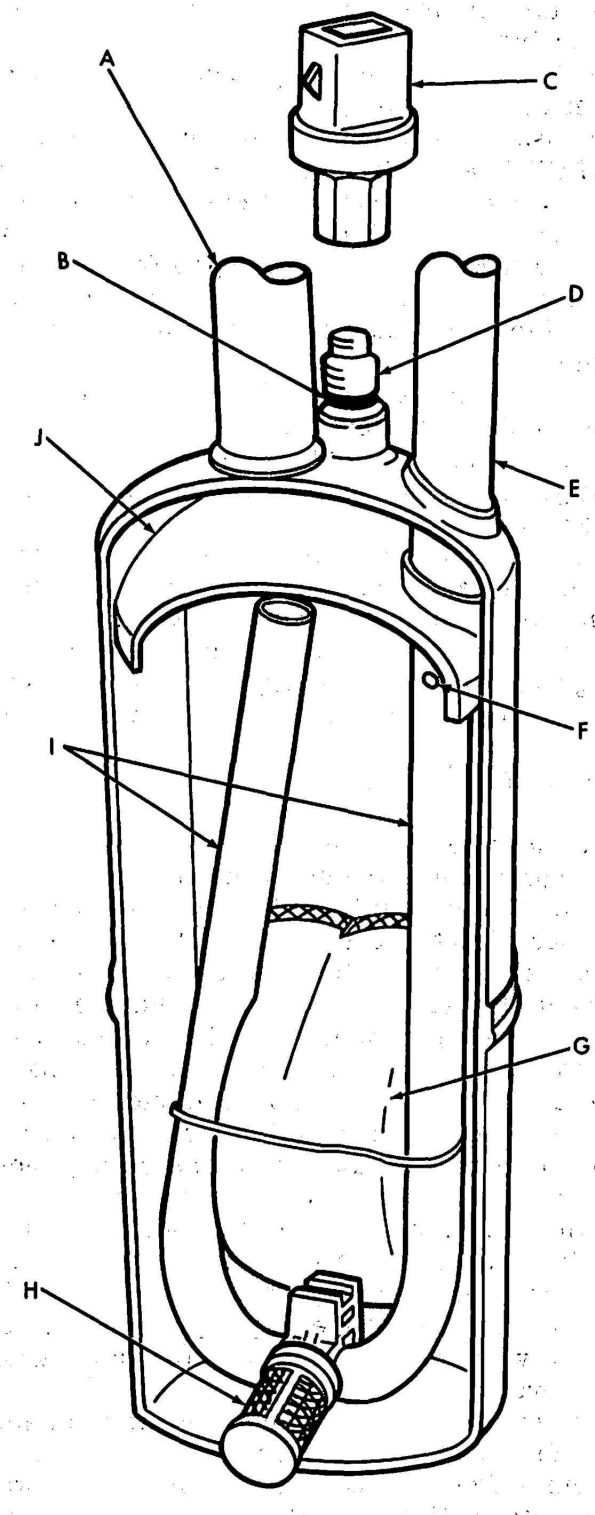
A fitting located on top of the canister is used to attach the clutch cycling pressure switch. A long travel Schrader-type valve stem core is installed in the fitting opening to prevent refrigerant loss when the clutch cycling pressure switch is removed.

If it is necessary to check the accumulator/drier for excessive refrigerant oil, the oil must be poured from the accumulator through the pressure switch fitting when the Schrader valve stem is removed.

Replacement Guidelines

Replace Accumulator/Drier when:

- The accumulator/drier is restricted, plugged or perforated.
- The system has been left open for more than 24 hours.



A. INLET FROM EVAPORATOR
B. O-RING SEAL
C. CLUTCH CYCLING PRESSURE SWITCH
D. PRESSURE SWITCH FITTING
E. OUTLET TO COMPRESSOR
F. ANTI-SIPHON HOLE
G. DESICCANT BAG
H. OIL RETURN ORIFICE FILTER
I. VAPOR RETURN TUBE
J. ACCUMULATOR DOME

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Fig. 2—Accumulator/Drier

• If there is evidence of moisture in the system ie., internal corrosion of metal lines or dark thick refrigerant oil.
• When the system is contaminated (such as if the compressor has seized). If the compressor has seized, also replace the fixed-orifice tube.

Do not replace Accumulator/drier every time if:
• There is a loss of refrigerant charge.
• A component such as a condenser, evaporator or compressor (except as previously described) is changed.
• A dent is found in the outer shell of the accumulator/drier.

EVAPORATOR CORE

The evaporator core is the plate/fin type with a multipass refrigerant flow path. A mixture of refrigerant and oil enters the bottom of the core through the evaporator inlet tube and is routed so that it flows in an S pattern through the evaporator and out the outlet tube. This S pattern eliminates the need for the liquid refrigerant and oil bleed line normally used on earlier plate/fin evaporator cores because of increased refrigerant flow velocity.

CLUTCH CYCLING PRESSURE SWITCH

The clutch cycling pressure switch is mounted on a Schrader valve type fitting on the top of accumulator/drier. A valve depressor, located inside the threaded end of the pressure switch, presses in on the Schrader valve stem as the switch is mounted and allows the suction pressure inside the accumulator/drier canister to control switch operation. The electrical switch contacts are normally open when the suction pressure is approximately 168 kPa (24.5 psi); they will close when the suction pressure rises to approximately 286 kPa (41.5 psi) or above. Lower ambient temperatures, below approximately 9°C (48°F), during cold weather will also open the clutch cycling pressure switch contacts due to the pressure/temperature relationship of the refrigerant in the system. The electrical switch contacts control the electrical circuit to the compressor magnetic clutch coil. When the switch contacts are closed, the clutch coil is energized and the A/C clutch is engaged to drive the compressor. When the switch contacts are open, the compressor magnet clutch coil is de-energized, the A/C clutch is disengaged and the compressor does not operate. The clutch cycling pressure switch, when functioning properly, will control the evaporator core pressure at a point where the plate/fin surface temperature will be maintained slightly

above freezing which prevents evaporator icing and the blockage of airflow.

FIXED ORIFICE TUBE

The fixed orifice tube assembly is the restriction between the high and low pressure liquid refrigerant and meters the flow of liquid refrigerant into the evaporator core. Minimum evaporator temperature is controlled by sensing the pressure within the evaporator with a pressure-operated electric switch. The pressure switch controls compressor operation as necessary to prevent evaporator freeze-up.

The fixed orifice tube is located in the liquid line near the condenser and has filter screens located on the inlet and outlet ends of the tube body. The filter screens act as a strainer for the liquid refrigerant flowing through the fixed orifice opening. O-rings, on the tube body, prevent the high pressure liquid refrigerant from bypassing the orifice. Adjustments cannot be made to the fixed orifice tube. If it becomes clogged or damaged it must be replaced (refer to Fixed Orifice Tube Removal).

Replacement Guidelines

The fixed orifice tube should be replaced whenever a compressor is replaced for lack of performance (internal damage).

PRESSURE RELIEF VALVE

A pressure relief valve is used to prevent excessive high pressure buildups of 3102 kPa (450 psi) and above, and prevent damage to the compressor and other system components. The pressure relief valve is located on the end of the compressor on the compressor head.

SERVICE GAUGE PORT VALVES

Two Schrader-type gauge ports are used with the refrigerant system. The high pressure service gauge port is located on the high pressure line near the compressor. The low pressure service gauge port is located on the accumulator under the cycling pressure switch.

After servicing the refrigerant system, install cap on service gauge port.

SAFETY PRECAUTIONS AND WARNINGS

R-12 Refrigerant Handling

Refrigerant Recycling

R-12 refrigerant is a chloroflorocarbon (CFC) that can contribute to the depletion of the ozone layer in the upper atmosphere. Ozone filters out harmful radiation from the sun. To assist in protecting the ozone layer, Chrysler Motors recommends that an R-12 refrigerant recycling device that meets SAE standard J1991 be used. Contact an automotive service equipment supplier for refrigerant recycling equipment that is available in your area. Refer to the operating instructions provided with the recycling equipment for proper operation.

WARNING: WEAR EYE PROTECTION WHEN SERVICING THE AIR-CONDITIONING REFRIGERANT SYSTEM, SERIOUS EYE INJURY CAN RESULT FROM EYE CONTACT WITH REFRIGERANT. IF EYE CONTACT IS MADE, APPLY A FEW DROPS OF MINERAL OIL TO THE EYES AND FLUSH WITH WATER FOR SEVERAL MINUTES. SEEK MEDICAL ATTENTION IMMEDIATELY.

DO NOT EXPOSE REFRIGERANT TO OPEN FLAME. POISONOUS GAS IS CREATED WHEN REFRIGERANT IS BURNED.

LARGE AMOUNTS OF REFRIGERANT RELEASED IN A CLOSED WORK AREA WILL DISPLACE THE OXYGEN AND CAUSE SUFFOCATION.

CAUTION: Liquid refrigerant is corrosive to metal surfaces.

Follow operating instructions and precautions supplied with equipment being used when servicing refrigerant system.

The evaporation rate of R-12 refrigerant at average temperature and altitude is extremely high. As a result, anything that comes in contact with the refrigerant will freeze. Always protect skin or delicate objects from direct contact.

Cooling System Precautions

WARNING: ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. IF SWALLOWED, DRINK TWO GLASSES OF WATER AND INDUCE VOMITING. IF INHALED, MOVE TO FRESH AIR AREA. SEEK MEDICAL ATTENTION IMMEDIATELY. DO NOT STORE IN OPEN OR UNMARKED CONTAINERS. WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL. KEEP OUT OF REACH OF CHILDREN.

DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT RUNNING TEMPERATURE. PERSONAL INJURY MAY RESULT.

The engine cooling system is designed to develop internal pressure of 97 to 123 kPa (14 to 18 psi) under normal operating conditions. Allow the vehicle approximately one half hour to cool off before opening the system. As an indicator of pressure in the cooling system, if the upper radiator hose collapses with little effort when squeezed

with index finger and thumb, the system would have low internal pressure and should be safe to open to the first safety notch of the radiator cap. Refer to Group 7, Cooling System.

SERVICE PRECAUTIONS

Never open or loosen a connection before discharging the system refrigerant.

When loosening a connection, if any residual pressure is evident, allow it to leak off before opening the fitting.

A system which has been opened to replace a component or one which has discharged through leakage must be evacuated before charging.

Immediately after disconnecting a component from the system, seal the open fittings with a cap or plug.

Before disconnecting a component from the system, clean the outside of the fittings thoroughly.

Do not remove the sealing caps from a replacement component until ready to install.

Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open an oil container until ready to use and install the cap immediately after using. Store the oil only in a clean moisture-free container.

Before connecting an open fitting always install a new seal ring. Coat the fitting and seal with clean refrigerant oil before connecting.

When installing a refrigerant line avoid sharp bends. Position the line away from the exhaust or any sharp edges which may chafe the line.

Tighten fittings only to the specified torque. The copper and aluminum fittings used in the A/C system will not tolerate over tightening.

When disconnecting a fitting use a wrench on both halves of the fitting to prevent twisting of the refrigerant lines or tubes.

Do not open a refrigerant system or uncap a replacement component unless it is as close as possible to room tamperature. This will prevent condensation from forming inside of a component which is cooler than the surrounding air.

Keep service tools and the work area clean. Contamination of A/C system through careless work habits must be avoided.

DIAGNOSIS AND TESTING

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VISUAL INSPECTION

Obstructed air passages, broken belts, disconnected or broken wires, loose clutch, loose or broken mounting brackets and many refrigerant leaks may be determined by visual inspection of the parts.

A refrigerant leak will usually appear as an oily residue at the leakage point in the system. The oily residue soon picks up dust or dirt particles from the surrounding air and appears greasy. Through time this will build up and appear to be a heavy dirt-impregnated grease.

Most common leaks are caused by damaged or missing O-ring seals at the various hose and component connections. When these O-rings are replaced, the new O-rings should be lubricated with refrigerant oil and care should be taken to keep lint from shop towels or rags from contaminating the internal surfaces of the connection. Leakage may occur at a spring lock coupling if the wrong O-rings are used at the coupling.

Another type of leak may appear at the internal Schrader-type A/C charging valve core in the service gauge port valve fittings. If tightening the valve core does not stop the leak, it should be replaced.

Missing service gauge port valve caps can also cause a refrigerant leak. If the valve cap is missing, dirt will enter the area of the A/C charging valve core. When the service hose is attached, the valve depressor in the end of the service hose forces the dirt into the valve seat area and the dirt will destroy the sealing surface of the A/C charging valve core. When a service gauge port valve cap is missing, the protected area of the A/C charging valve core should be cleaned and a new service gauge port valve cap should be installed.

CAUTION: Service gauge port valve caps must be installed finger tight. If tightened with pliers, the sealing surface of the service gauge port valve may be damaged.

CLUTCH TESTING

If field coil wire is broken, replace field coil.

Check amperage and voltage. The amperage range requirements is 3.6 to 4.2 at 12 volts.

- A very high amperage reading indicates a short within the field coil.
- No amperage reading indicates an open circuit in the winding.
- An intermittent or poor system ground results in lower voltage at the clutch. Check for tight fit of coil retaining snap ring or coil retaining screws for ground.

An incorrect air gap could cause erratic engagement or disengagement and/or clutch rattle. Check the air gap with a feeler gauge as described in Clutch Installation.

If bearing noise is suspected perform the following:

- Remove belt. Disengage clutch.
- Rotate rotor pulley by hand.

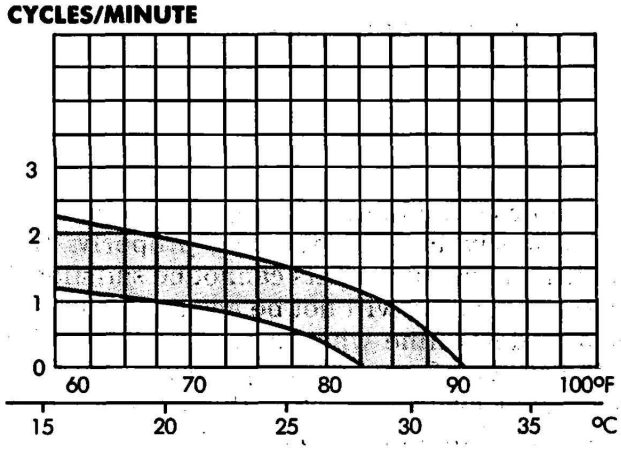
Listen for bearing noise. Feel for hard spots. If excessive, replace rotor pulley and clutch front plate assembly or bearing set.

REFRIGERANT SYSTEM

General Information

Diagnosis of the refrigerant system can best be performed by analyzing the clutch cycle rate (time ON plus time OFF) and the refrigerant system pressures, which will vary between high and low points during the clutch cycle. Compare the system pressures and clutch cycle rate to the chart to determine if the system pressures and clutch cycle rate are normal. The conditional requirements given for the refrigerant system tests must be satisfied to obtain accurate pressure readings.

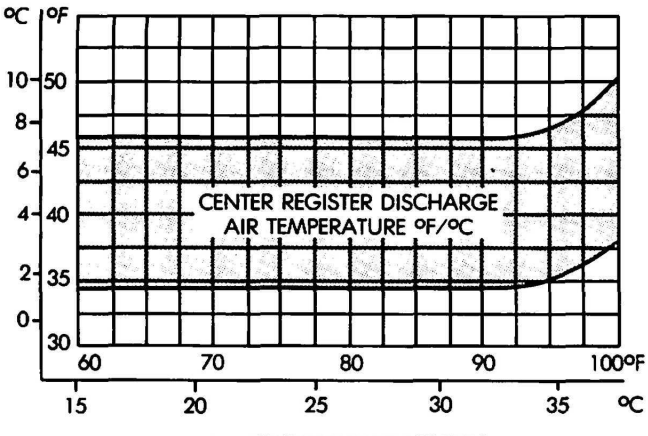
NORMAL CLUTCH CYCLE RATE PER MINUTE



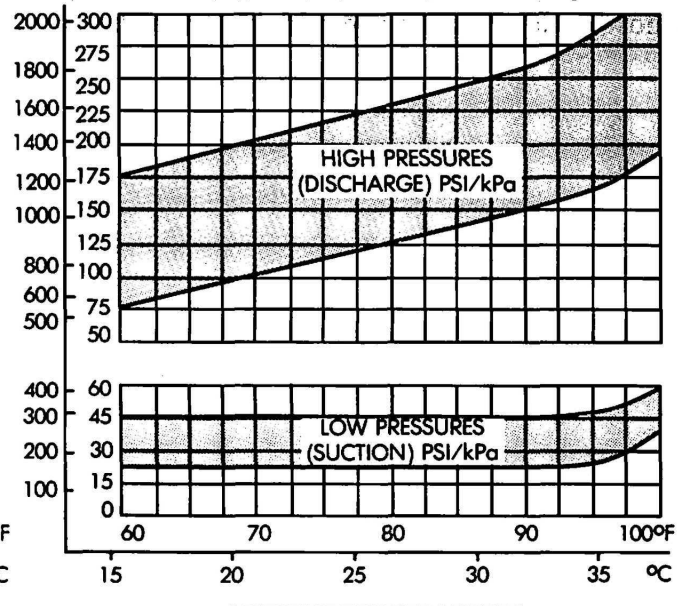
THESE CONDITIONAL REQUIREMENTS FOR THE FIXED ORIFICE TUBE CYCLING CLUTCH SYSTEM TESTS MUST BE SATISFIED TO OBTAIN ACCURATE PRESSURE READINGS.

- STABILIZED IN CAR TEMPERATURE @ 70°F TO 80°F (21°C TO 27°C)
- MAXIMUM A/C (RECIRCULATING AIR)
- MAXIMUM BLOWING SPEED
- 1500 ENGINE RPM FOR 10 MINUTES

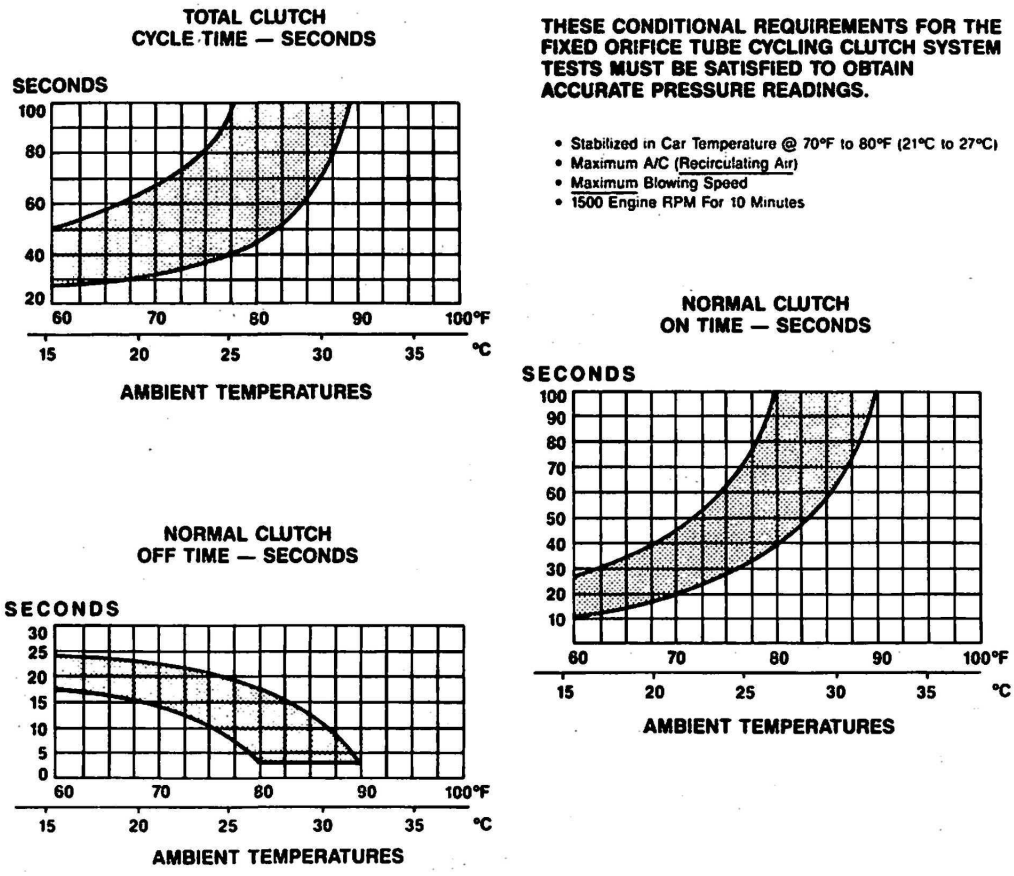
NORMAL CENTER REGISTER DISCHARGE TEMPERATURES



NORMAL FIXED ORIFICE TUBE CYCLING CLUTCH REFRIGERANT SYSTEM PRESSURES



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E8924-167

The lowest pressure recorded on the low pressure gauge (observed when the clutch is disengaged) is the low pressure setting of the clutch cycling pressure switch. The pressure recorded when the clutch engages is the high pressure setting of the pressure switch.

If the conditional requirements given in the chart are not satisfied, the pressure readings will not be accurate and could indicate that a system or component that appears to be operating properly is not operating properly. If the conditional requirements cannot be satisfied, the pressure reading will not be accurate but can be used to determine what is causing the problem in the system. Compare the pressure results and the clutch cycle rate with the pressure conditions and clutch cycle time chart.

REFRIGERANT SYSTEM PRESSURE AND CLUTCH CYCLE TIMING EVALUATION CHART FOR FIXED ORIFICE TUBE CYCLING CLUTCH SYSTEMS

NOTE: Normal system conditional requirements must be maintained to properly evaluate refrigerant system pressures. Refer to charts applicable to system under test.

HIGH (DISCHARGE) PRESSURE	LOW (SUCTION) PRESSURE	CLUTCH CYCLE TIME			COMPONENT — CAUSES
		RATE	ON	OFF	
HIGH	HIGH	CONTINUOUS RUN			CONDENSER — Inadequate Airflow
HIGH	NORMAL TO HIGH				ENGINE OVERHEATING
NORMAL TO HIGH	NORMAL				AIR IN REFRIGERANT. REFRIGERANT OVERCHARGE (a) HUMIDITY OR AMBIENT TEMP. VERY HIGH (b).
NORMAL	HIGH				FIXED ORIFICE TUBE — Missing. O-Rings Leaking/Missing
NORMAL	HIGH	SLOW	LONG	LONG	CLUTCH CYCLING SWITCH — High Cut-In
NORMAL	NORMAL	SLOW OR NO CYCLE	LONG OR CONTINUOUS	NORMAL OR NO CYCLE	MOSITURE IN REFRIGERNAT SYSTEM. EXCESSIVE REFRIGERANT OIL
		FAST	SHORT	SHORT	CLUTCH CYCLING SWITCH — Low Cut-In or High Cut-Out
NORMAL	LOW	SLOW	LONG	LONG	CLUTCH CYCLING SWITCH — Low Cut-Out
NORMAL TO LOW	HIGH	CONTINUOUS RUN			Compressor — Low Performance
NORMAL TO LOW	NORMAL TO HIGH				A/C SUCTION LINE — Partially Restricted or Plugged (c)
NORMAL TO LOW	NORMAL	FAST	SHORT	NORMAL	EVAPORATOR — Low Airflow
			SHORT TO VERY SHORT	NORMAL TO LONG	CONDENSER, FIXED ORIFICE TUBE, OR A/C LIQUID LINE - Partially Restricted or Plugged
			SHORT TO VERY SHORT	SHORT TO VERY SHORT	LOW REFRIGERANT CHARGE
			SHORT TO VERY SHORT	LONG	EVAPORATOR CORE — Partially Restricted or Plugged
NORMAL TO LOW	LOW	CONTINUOUS RUN			A/C SUCTION LINE — Partially Restricted or Plugged. (d) CLUTCH CYCLING SWITCH — Sticking Closed
LOW	NORMAL	VERY FAST	VERY SHORT	VERY SHORT	CLUTCH CYCLING SWITCH — Cycling Range Too Close
ERRATIC OPERATION OR COMPRESSOR NOT RUNNING		—	—	—	CLUTCH CYCLING SWITCH — Dirty Contacts or Sticking Open. POOR CONNECTION AT A/C CLUTCH CONNECTOR OR CLUTCH CYCLING SWITCH CONNECTOR. A/C ELECTRICAL CIRCUIT ERRATIC — See A/C Electrical Circuit Wiring Diagram

ADDITIONAL POSSIBLE CAUSE COMPONENTS ASSOCIATED WITH INADEQUATE COMPRESSOR OPERATION

- COMPRESSOR CLUTCH Slipping • LOOSE DRIVE BELT
- CLUTCH COIL Open — Shorted, or Loose Mounting
- CONTROL ASSEMBLY SWITCH — Dirty Contacts or Sticking Open
- CLUTCH WIRING CIRCUIT — High Resistance, Open or Blown Fuse
- A/C HIGH PRESSURE CUT-OUT SWITCH — Dirty Contacts or Sticking Open (If So Equipped)

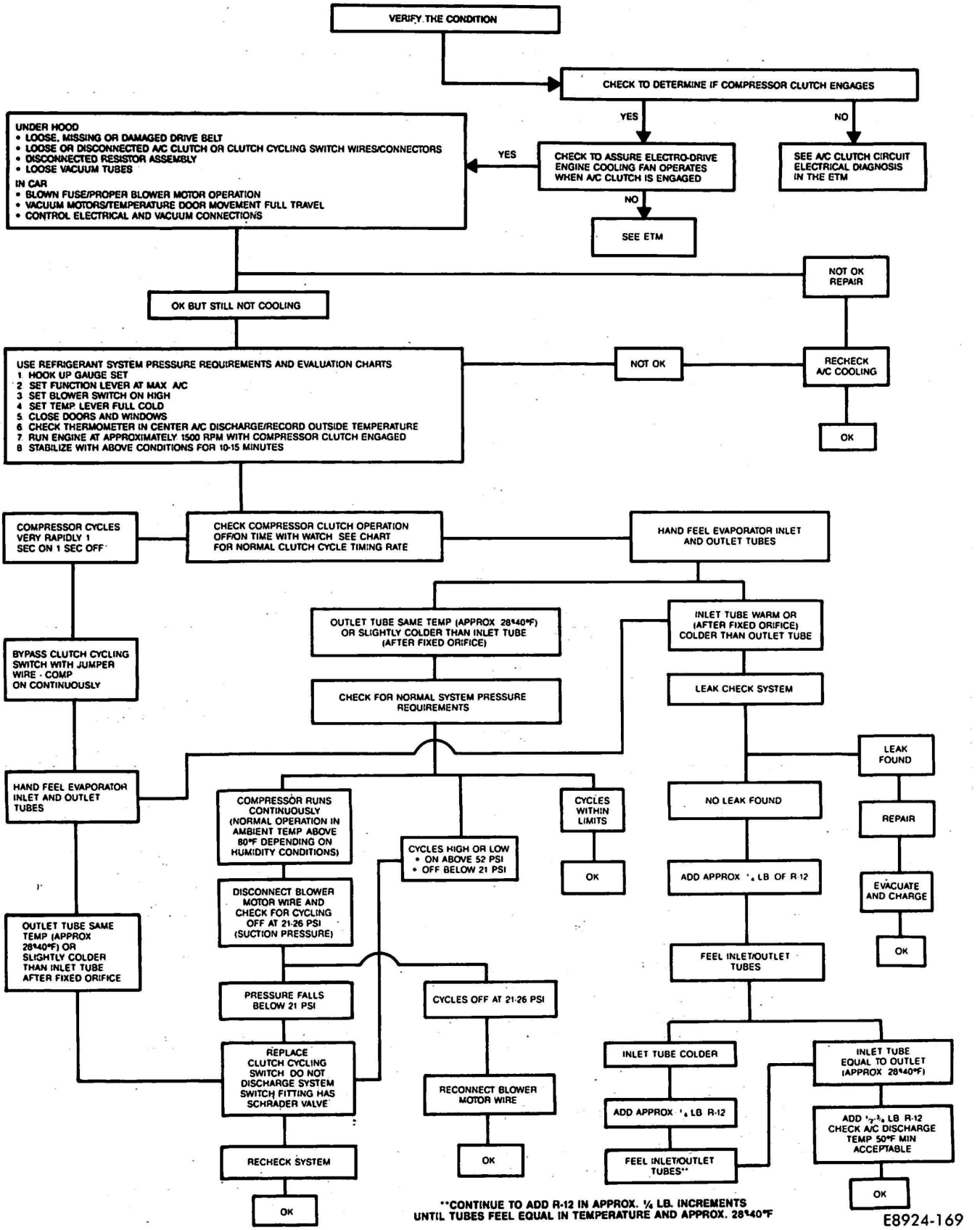
ADDITIONAL POSSIBLE CAUSE COMPONENTS ASSOCIATED WITH A DAMAGED COMPRESSOR

- CLUTCH CYCLING SWITCH — Sticking Closed or Compressor Clutch Seized
- SUCTION ACCUMULATOR DRIER — Refrigerant Oil Bleed Hole Plugged
- REFRIGERANT LEAKS

(a) Compressor may make noise on initial run. This is slugging condition caused by excessive liquid refrigerant.
(b) Compressor clutch may not cycle in ambient temperatures above 80°F depending on humidity conditions.
(c) Low pressure reading will be normal to high if pressure is taken at accumulator and if restriction is downstream of service access valve.
(d) Low pressure reading will be low if pressure is taken near the compressor and restriction is upstream of service access valve.

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INSUFFICIENT A/C COOLING — PARTIAL REFRIGERANT CHARGING TO FILL FIXED ORIFICE TUBE CYCLING CLUTCH SYSTEMS



After servicing and correcting a refrigerant system problem, take additional pressure readings and observe the clutch cycle rate while meeting the conditional requirements to be sure the problem has been corrected.

In ambient temperatures above 32°C (90°F), the compressor clutch will not normally cycle off. This will depend on local conditions and engine/vehicle speed. Also, clutch cycling will normally not occur when the engine is operating at curb idle speed.

If the system contains no refrigerant or is extremely low on refrigerant, the clutch will not engage for compressor operation. A rapid cycling compressor clutch is usually an indication that the system is low on refrigerant. Refer to chart if insufficient cooling condition exists.

TEMPERATURE-PRESSURE RELATIONSHIP CHART (FOR REFRIGERANT 12)

TEMP. °F	PRESS. PSI	TEMP. °F	PRESS. PSI	TEMP. °F	PRESS. PSI	TEMP. °F	PRESS. PSI	TEMP. °F	PRESS. PSI
0	9.1	35	32.5	60	57.7	85	91.7	110	136.0
2	10.1	36	33.4	61	58.9	86	93.2	111	138.0
4	11.2	37	34.3	62	60.0	87	94.8	112	140.1
6	12.3	38	35.1	63	61.3	88	96.4	113	142.1
8	13.4	39	36.0	64	62.5	89	98.0	114	144.2
10	14.6	40	36.9	65	63.7	90	99.6	115	146.3
12	15.8	41	37.9	66	64.9	91	101.3	116	148.4
14	17.1	42	38.8	67	66.2	92	103.0	117	151.2
16	18.3	43	39.7	68	67.5	93	104.6	118	152.7
18	19.7	44	40.7	69	68.8	94	106.3	119	154.9
20	21.0	45	41.7	70	70.1	95	108.1	120	157.1
21	21.7	46	42.6	71	71.4	96	109.8	121	159.3
22	22.4	47	43.6	72	72.8	97	111.5	122	161.5
23	23.1	48	44.6	73	74.2	98	113.3	123	163.8
24	23.8	49	45.6	74	75.5	99	115.1	124	166.1
25	24.6	50	46.6	75	76.9	100	116.9	125	168.4
26	25.3	51	47.6	76	78.3	101	118.8	126	170.7
27	26.1	52	48.7	77	79.2	102	120.6	127	173.1
28	26.8	53	49.8	78	81.1	103	122.4	128	175.4
29	27.6	54	50.9	79	82.5	104	124.3	129	177.8
30	28.4	55	52.0	80	84.0	105	126.2	130	182.2
31	29.2	56	53.1	81	85.5	106	128.1	131	182.6
32	30.0	57	55.4	82	87.0	107	130.0	132	185.1
33	30.9	58	56.6	83	88.5	108	132.1	133	187.6
34	31.7	59	57.1	84	90.1	109	135.1	134	190.1

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Leak Checking

Attach the manifold gauge set. Leave both manifold gauge valves at the maximum clockwise (closed) position. Both gauges should show pressure as indicated on the chart with the engine not running. If little or no pressure is indicated, attach a refrigerant source to the center hose and open the low pressure manifold gauge valve. This opens the system to tank pressure. Check all connections, the compressor head gasket, oil filler plug, and shaft seal for leaks, using a good refrigerant leak detector.

Follow the manufacturer's calibration instructions, included with the unit, to set up the electronic leak detector for proper operation.

Move the flexible probe slowly under any suspected connections, joints and seals. Leaks may be detected more readily on the lower side or areas being checked because R-12 refrigerant is heavier than air.

Repair leaks as required.

Evacuate and leak-test the system after all the leaks are corrected.

Charge the system.

Using an electronic leak detector will not expose the user to phosgene gas vapors or fumes.

REFRIGERANT SYSTEM SERVICE

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SYSTEM DISCHARGING

Refrigerant Recycling

R-12 refrigerant is a chloroflorocarbon (CFC) that can contribute to the depletion of the ozone layer in the upper atmosphere. Ozone filters out harmful radiation from the sun. To assist in protecting the ozone layer, Chrysler Motors recommends that an R-12 refrigerant recycling device that meets SAE standard J1991 be used when it is necessary to discharge the refrigerant system. Contact an automotive service equipment supplier for refrigerant recycling equipment that is available in your area. Refer to the operating instructions provided with the recycling equipment for proper operation.

(1) Remove the cap (Fig. 1) from the high pressure service gauge port valve.

(2) Disconnect the cycling pressure switch connector (Fig. 2) and unscrew the cycling pressure switch.

(3) Turn both manifold gauge valves fully clockwise to close the high and low pressure hoses to

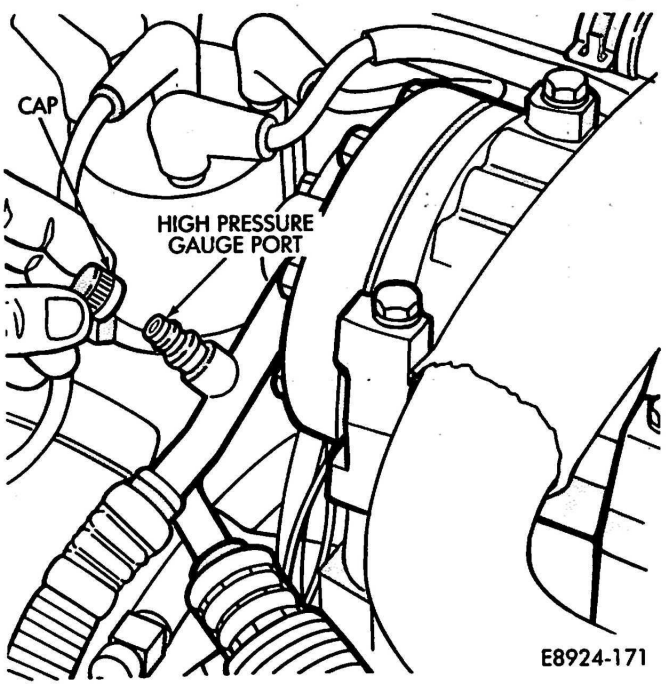


Fig. 1—Remove Cap From High Pressure Gauge Port

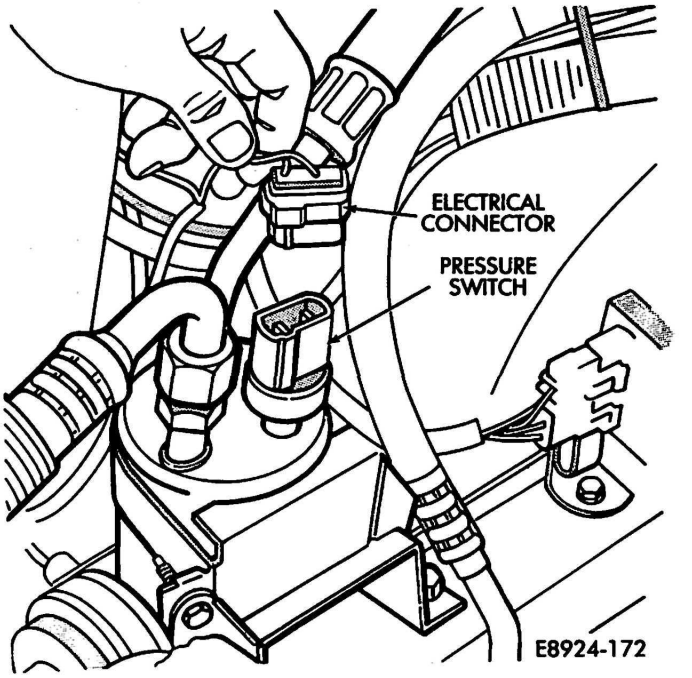


Fig. 2—Disconnect Pressure Switch

the center manifold and hose (Fig. 3).

If the gauge set hoses do not have the service valve depressor pins, install adapters containing the service valve pin depressor pins.

(4) Connect the gauge set high pressure hose (Fig. 4) to the high pressure service gauge port valve.

(5) Connect the gauge set low pressure hose (Fig. 5) to the low pressure service gauge port valve.

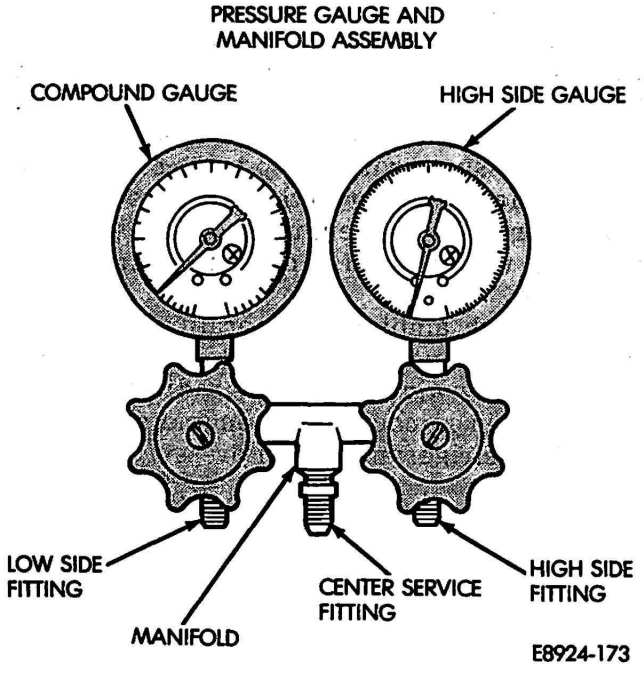


Fig. 3—Manifold Gauge Set

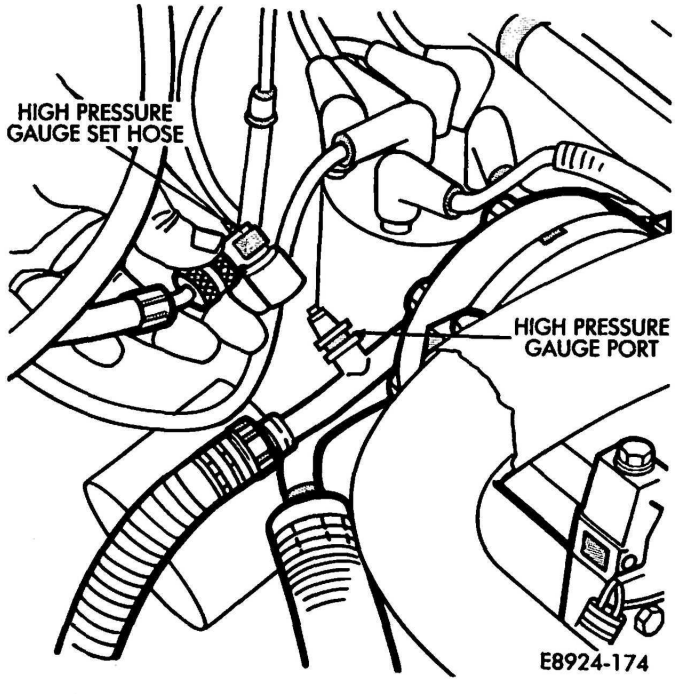


Fig. 4—Connect High Pressure Gauge Set Hose

(6) Place the open end of the center hose in a garage exhaust outlet.

CAUTION: Discharging the refrigerant system too rapidly will cause refrigerant oil to be sucked out of the compressor and discharged along with refrigerant.

(7) Slowly de-pressurize the refrigeration system by opening the low pressure valve of the manifold gauge set a slight amount and allowing the refrigerant to discharge slowly from the system.

(8) After the system is nearly discharged, open the high pressure gauge valve very slowly to avoid losing any refrigerant oil and allow any refrigerant remaining in the compressor and high pressure line to discharge.

SYSTEM EVACUATING

(1) Discharge the refrigerant system as described.

(2) Ensure that the manifold gauge set is connected as follows:

- Low pressure hose connected to the low pressure service gauge port on the top center of the accumulator/drier.
- High pressure hose connected to the high pressure service gauge port on the compressor discharge line.
- Connect the manifold gauge set center hose to a vacuum pump.

(3) Open the manifold gauge set valves and start the vacuum pump.

(4) Evacuate the system with the vacuum pump until the low pressure gauge reads at least 84.2 kPa (25 inch Hg) vacuum and as close to 491.6 cm (30 inches) as possible. Continue the vacuum pump operation for 30 minutes.

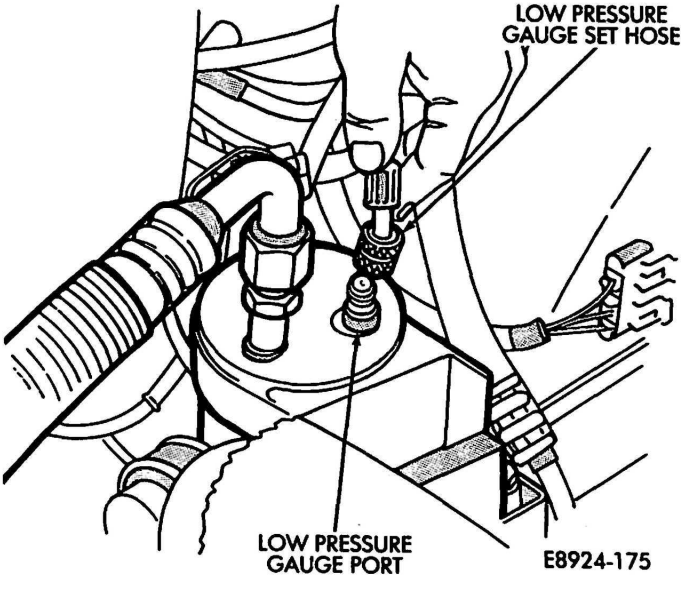


Fig. 5—Connect Low Pressure Gauge Set Hose

(5) When evacuation of the system is complete, close the manifold gauge set valves and turn off the vacuum pump.

(6) Observe the low pressure gauge to be sure the system holds vacuum for 5 minutes. If vacuum is held for 5 minutes, proceed to charging the system. If vacuum is not held for 5 minutes, leak test the system, repair leak(s) and evacuate the system.

SYSTEM CHARGING

(1) With the manifold gauge set valves closed to the center hose, disconnect the vacuum pump from the manifold gauge set.

(2) Connect the center hose of the manifold gauge set to a refrigerant drum.

(3) Loosen the center hose at the manifold gauge set and open the refrigerant drum valve. Allow some refrigerant to escape to purge air and moisture from the center hose. Tighten the center hose connection at the manifold.

(4) Install a jumper wire across the two terminals of the cycling pressure switch harness connector.

(5) Open the manifold gauge set LOW SIDE valve to allow refrigerant to enter the system. Keep refrigerant can in an upright position.

WARNING: FAILURE TO KEEP REFRIGERANT CAN IN AN UPRIGHT POSITION MAY CAUSE DAMAGE TO THE COMPRESSOR.

(6) When no more refrigerant is being drawn into the system, start the engine and press the select switch until Max A/C is selected. Press the blower switch to select Hi allowing the remaining refrigerant to be drawn into the system.

(7) Continue to add refrigerant to the system until the specified weight (36 oz.) of R-12 is in the system. Close the manifold gauge set low pressure valve and the refrigerant supply valve.

(8) Remove the jumper wire from the clutch cycling pressure switch snap-lock connector and connect the connector to the pressure switch.

(9) Operate the system until the pressures stabilize to verify normal operation and system pressures.

(10) In high ambient temperatures, it may be necessary to operate a high volume fan positioned to blow air through the radiator and condenser to aid in cooling the engine and prevent excessive refrigerant system pressures.

COMPONENT REPLACEMENT

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HEATER-A/C UNIT

The heater-A/C unit must be removed from the vehicle if the heater core or evaporator core must be replaced. Review all safety precautions in Refrigerant System Service section of this group and Group 7, Cooling System.

Removal or Installation

In the engine compartment perform the following:

(1) Disconnect battery negative cable, see Group 8A, Battery.

(2) Drain cooling system, see Group 7, Cooling System.

(3) If equipped with A/C, discharge refrigerant system, see Refrigerant System Service section of this group.

CAUTION: When removing hoses from heater core inlet or outlet nipples DO NOT use excessive force. Damage to heater core can result.

(4) Disconnect heater hoses and plug heater core nipples to avoid spilling coolant in passenger compartment.

(5) Disconnect coolant level indicator switch connector and remove coolant recovery bottle, leave hose connected, position bottle out of the way.

(6) Remove coolant recovery bottle mounting bracket.

(7) Disconnect heater-A/C blower motor wire connector.

(8) Disconnect vacuum supply hose.

(9) Disconnect refrigerant lines from A/C unit at dash panel, see Component Description section of this group. Cover all open lines and coupling ends with plastic sheeting and tape to avoid excessive contamination to refrigerant system.

(10) Remove heater-A/C unit attaching (4) nuts securing unit to dash panel.

In the passenger compartment perform the following:

(11) Remove steering column, see Group 19, Steering.

(12) Remove instrument panel, see Group 8E, Instrument Panel.

(13) Remove floor air distribution duct.

(14) Remove heater-A/C unit attaching (2) nuts securing unit to plenum.

(15) Remove heater-A/C unit from vehicle. When installing unit, feed condensate drain tube, vacuum line, and blower wiring through proper holes in dash panel.

To install, reverse the preceding operation. Evacuate and charge refrigerant system and test heat and A/C performance, refer to appropriate sections of this group.

HEATER CORE REPLACEMENT

(1) Remove heat and A/C housing as described in this section.

(2) Release plastic tabs (Fig. 1) and remove heater core.

(3) To install heater core, carefully insert heater core into housing and push until it snaps into place.

(4) Install heat and A/C housing as described in this section.

EVAPORATOR CORE

Removal

(1) Remove heat and A/C housing as described in this section.

(2) Remove vacuum connector (Fig. 1) from Air Conditioning Module (ACM) (Fig. 2).

(3) Remove electrical connectors (Fig. 2) from ACM.

(4) Remove mounting screws and ACM.

(5) While unlocking retaining tab, remove motor arm from door pivot arm.

(6) Remove spring and clear vacuum line from motor.

(7) Lift up and pull hose (Fig. 1) out of its hole in the housing.

(8) Disengage tabs and remove heater core.

(9) Remove foam gaskets (Figs. 1, 2).

(10) Pry off retaining clip (Fig. 3) and disconnect wires from the blower motor.

(11) Remove blower motor mounting screws and remove blower motor.

(12) Remove screws (Fig. 1) that hold upper and lower housing halves together.

(13) Remove clips that hold upper and lower halves together.

(14) Separate upper and lower housing halves.

(15) Remove evaporator core (Fig. 2).

Installation

CAUTION: Failure to maintain the correct oil level in the system will cause compressor failure. Too much oil in the system will decrease system efficiency and possibly cause system noise.

Add 88.7ml (3 fluid oz) of clean refrigerant oil to the accumulator/drier inlet tube whenever the evaporator core is replaced. This will compensate for the refrigerant oil lost in the replaced evaporator core.

(1) Position the evaporator core in the lower housing.

(2) Position upper housing on lower housing. Ensure that upper half is seated in groove on blower motor trim ring (Fig. 1). If the trim ring is not seated properly, a tapping noise may occur when the housing is installed in the vehicle.

(3) With halves mated, reach inside housing and position blend door pivot shaft into opening (Fig. 1).

(4) Install clips around middle joint of housing halves.

(5) Install screws that hold upper lower halves together.

(6) Install blower motor with screws.

(7) Connect wires to blower motor and secure them in place with retaining clip.

(8) Install foam gaskets (Figs. 1, 2).

(9) Carefully insert heater core into housing and push down until it snaps into place.

(10) Slide hose (Fig. 1) into housing then press down to lock it in place.

(11) Slide vacuum motor arm onto recirculation door pivot shaft. Press it until tab (Fig. 2) locks in place.

(12) Connect spring to vacuum motor arm and to housing.

(13) Install ACM with screws.

(14) Install vacuum connector to ACM.

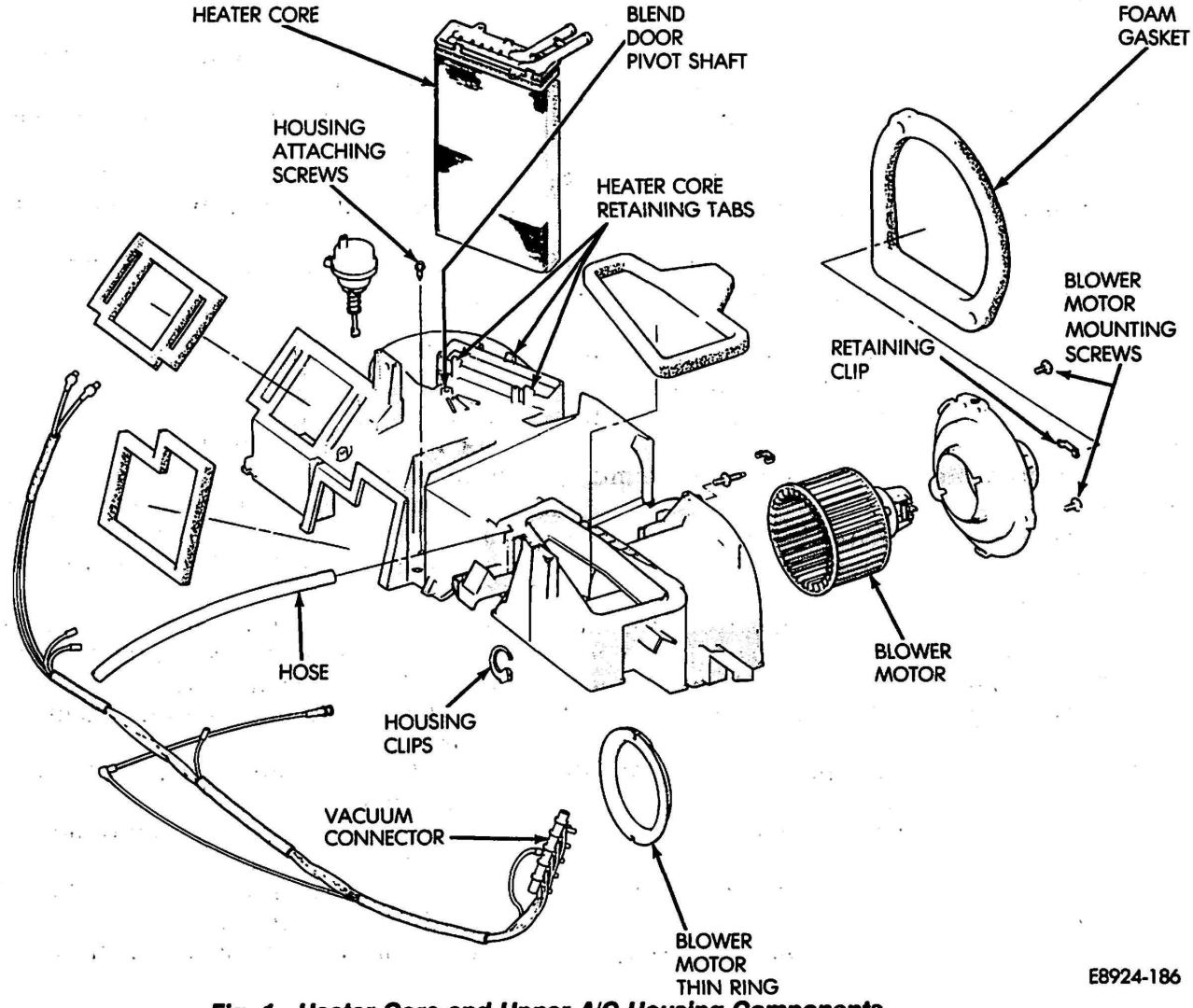


Fig. 1—Heater Core and Upper A/C Housing Components

(15) Install electrical connector to ACM.
(16) Install heat and A/C housing as described in this section.

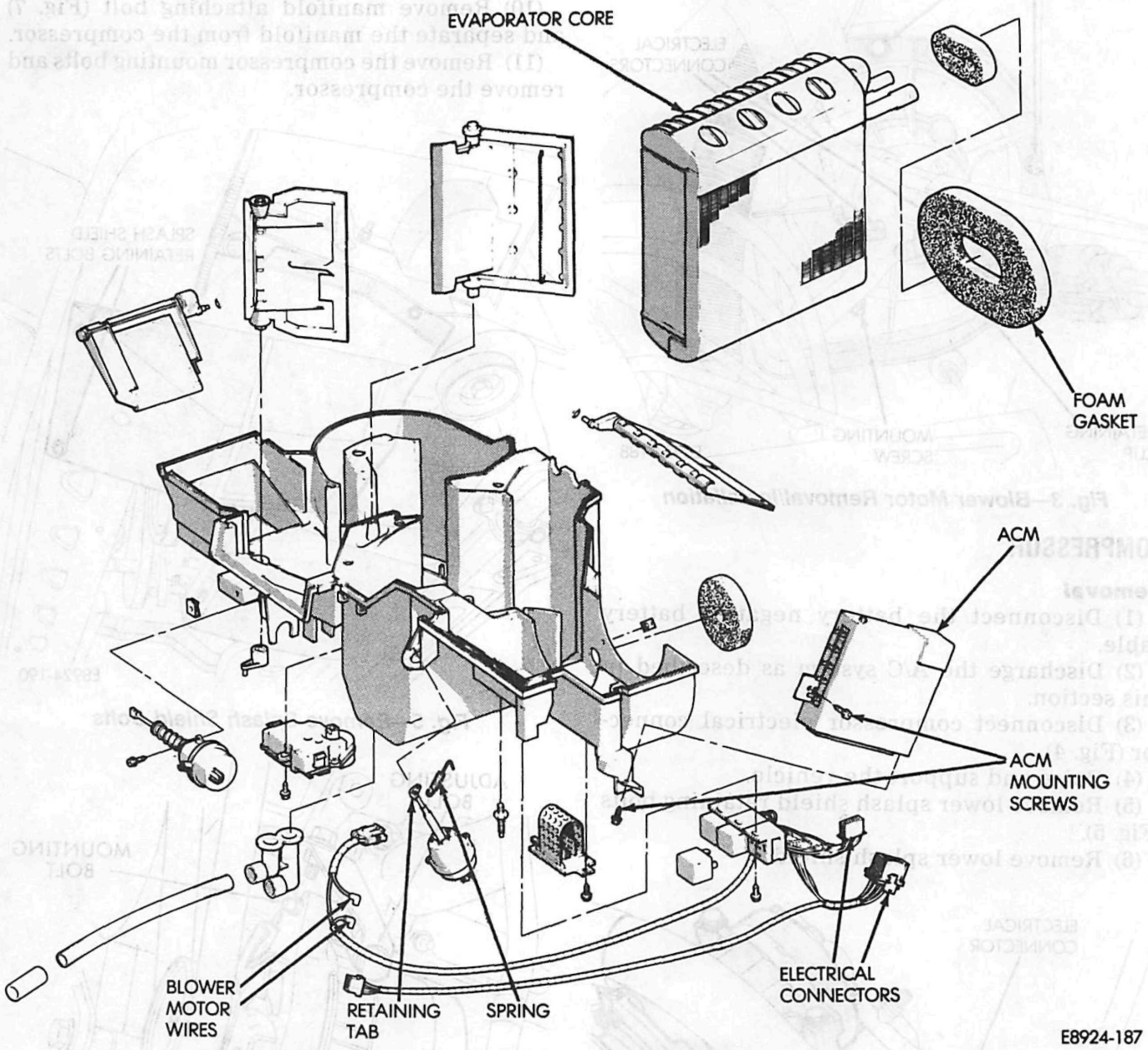


Fig. 2—Evaporator Core and Lower A/C Housing Components

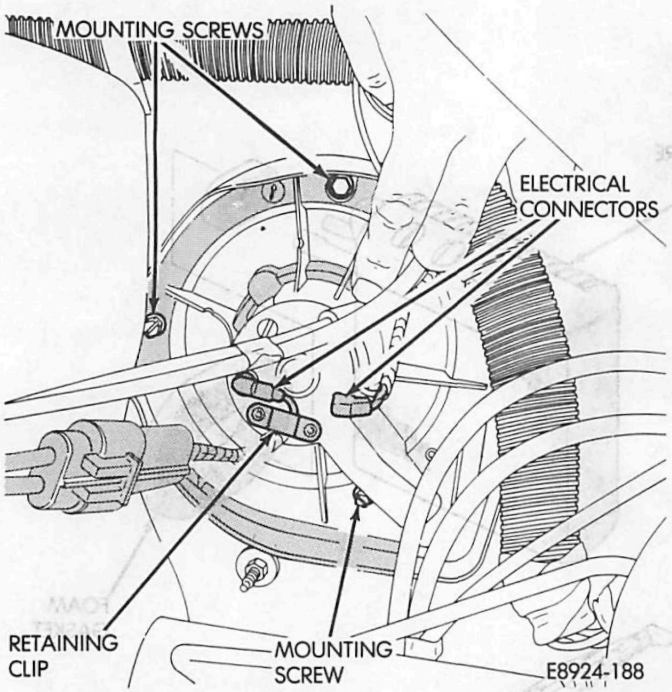


Fig. 3—Blower Motor Removal/Installation

COMPRESSOR

Removal

(1) Disconnect the battery negative battery cable.

(2) Discharge the A/C system as described in this section.

(3) Disconnect compressor electrical connector (Fig. 4).

(4) Raise and support the vehicle.

(5) Remove lower splash shield retaining bolts (Fig. 5).

(6) Remove lower splash shield.

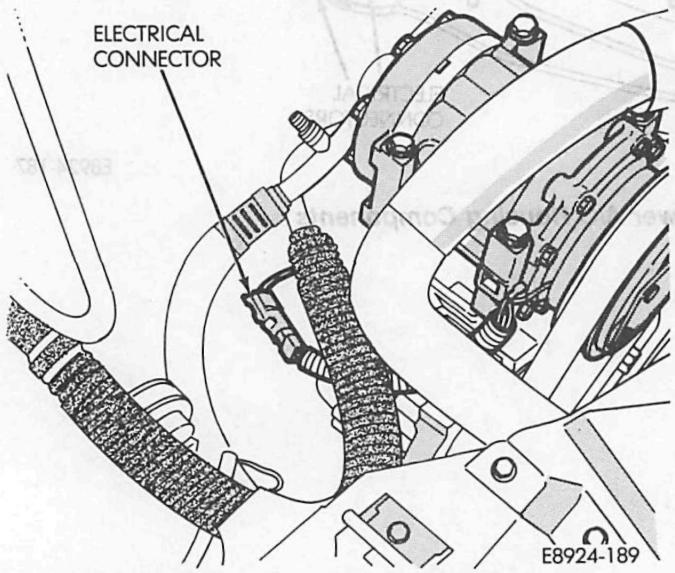


Fig. 4—Disconnect Electrical Connector

(7) Relieve tension on drive belt by turning adjusting bolt (Fig. 6).

(8) Loosen alternator mounting bolts.

(9) Remove accessory drive belt.

(10) Remove manifold attaching bolt (Fig. 7) and separate the manifold from the compressor.

(11) Remove the compressor mounting bolts and remove the compressor.

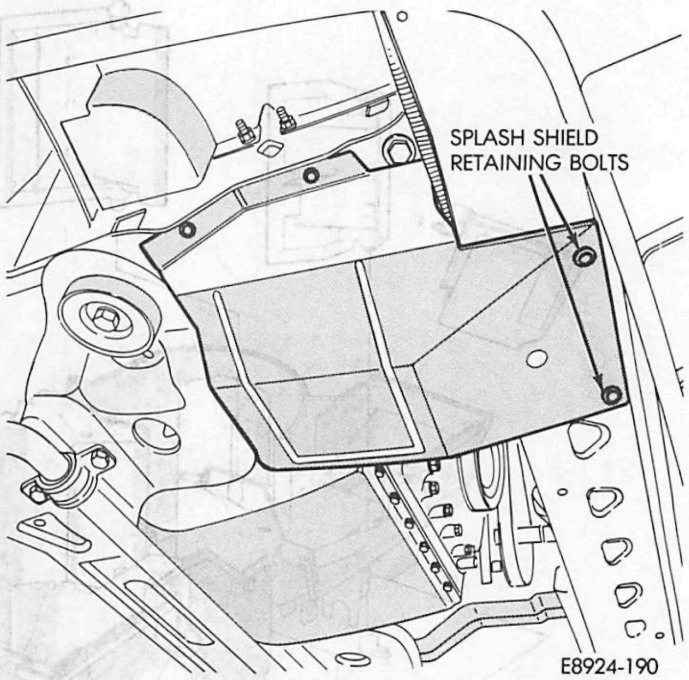


Fig. 5—Remove Splash Shield Bolts

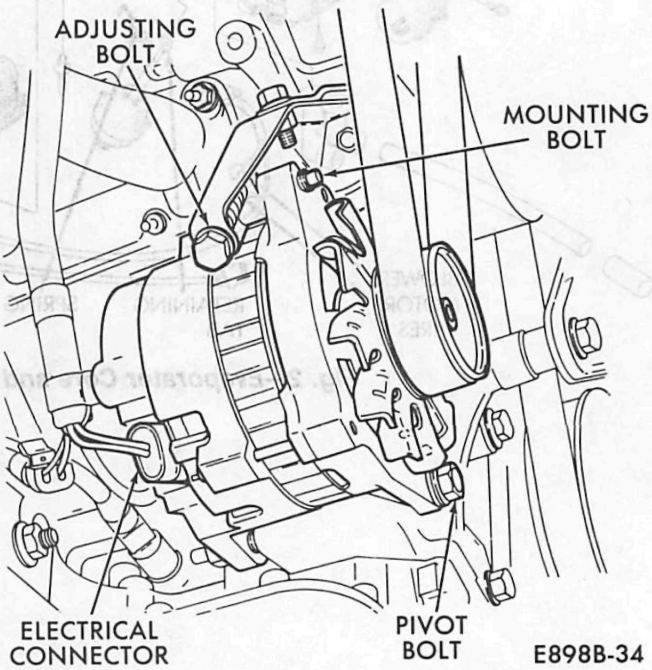


Fig. 6—Loosen Alternator

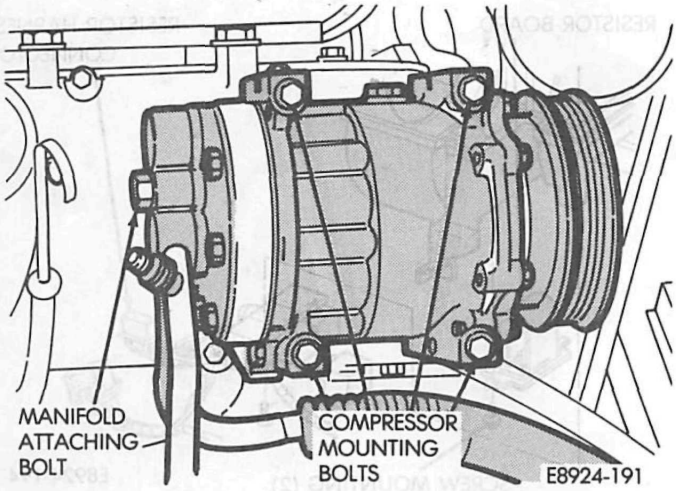


Fig. 7—Compressor Removal/Installation

Installation

If a replacement compressor is being installed, the correct amount of oil should be installed along with the new compressor. Drain and measure the amount of oil in the old compressor. Drain the oil from the new compressor and install the amount of oil removed from the old compressor plus 1 oz.

(1) Position the compressor and install the compressor mounting bolts. Tighten bolts to 27 N·m (20 ft-lbs).

(2) Install the accessory drive belt over the alternator pulley.

(3) Torque alternator pivot bolt to 40 N·m (30 ft-lbs).

(4) Install a belt tension gauge in the middle of a belt span. Ensure that the tension gauge is not touching any engine component.

(5) Tighten adjusting bolt until the correct belt tension is obtained:

New Belt 800-900 N (180-200 lbs), Used Belt 623-712 N (140-160 lbs).

(6) Torque alternator upper mounting bolt to 27 N·m (20 ft-lbs).

(7) Recheck torque on pivot bolt.

(8) Install splash shield.

(9) Lower vehicle.

(10) Lubricate new O-rings with clean refrigerant oil and position them in the O-ring grooves of the manifold.

(11) Position the manifold and hose assembly with new O-rings to the compressor and install the attaching bolts. Tighten the bolts to 37 N·m (28 ft lbs).

(12) Connect the compressor electrical connector.

(13) Connect the battery negative cable.

(14) Leak test, evacuate and charge the system as described in this section.

ACCUMULATOR/DRIER

Removal

(1) Disconnect the battery negative cable.

(2) Discharge the A/C system as described in this section.

(3) Loosen the locknut (Fig. 8) located on the accumulator/drier hose.

(4) Remove A/C line (Fig. 9) at the dash panel using the appropriate tool.

(5) Remove accumulator/drier mounting bolts (Fig. 10).

(6) Remove accumulator/drier and bracket.

(7) Loosen securing bolt and separate bracket and accumulator.

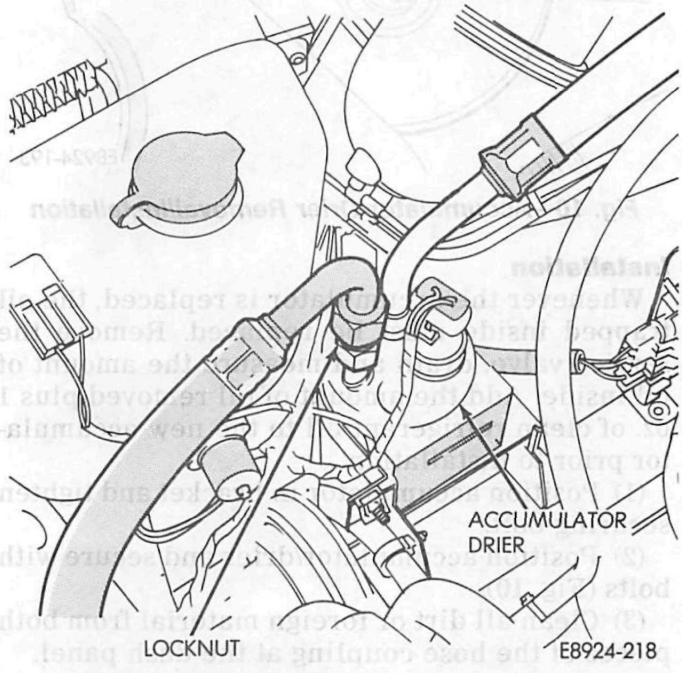


Fig. 8—Loosen Locknut

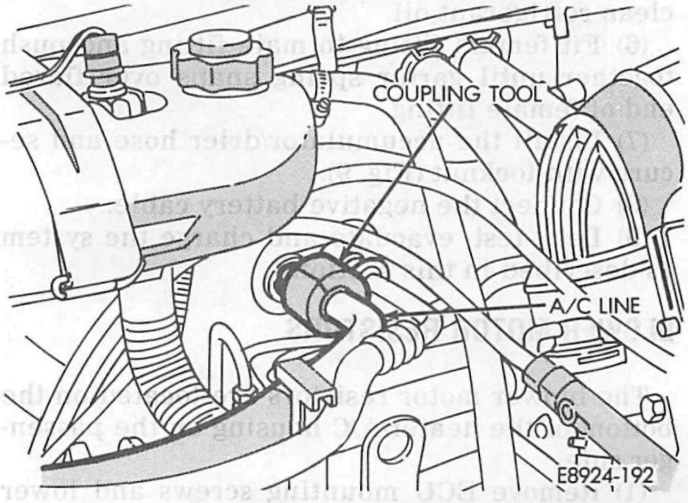


Fig. 9—Remove A/C Line With Coupling Tool

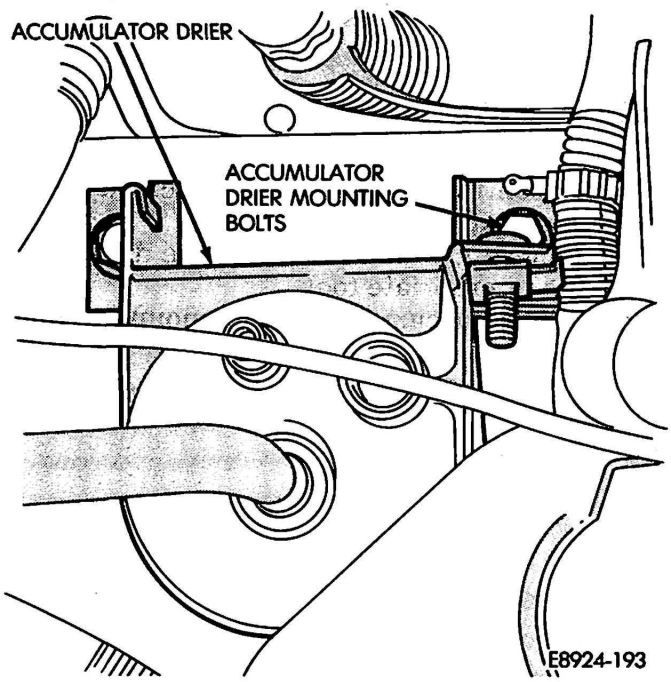


Fig. 10—Accumulator Drier Removal/Installation

Installation

Whenever the accumulator is replaced, the oil trapped inside must be replaced. Remove the service valve, drain and measure the amount of oil inside. Add the amount of oil removed plus 1 oz. of clean refrigerant oil to the new accumulator prior to installation.

(1) Position accumulator in bracket and tighten securing bolt.

(2) Position accumulator/drier and secure with bolts (Fig. 10).

(3) Clean all dirt or foreign material from both pieces of the hose coupling at the dash panel.

(4) Install new O-rings on the male fitting.

(5) Lubricate the male fitting and O-rings with clean refrigerant oil.

(6) Fit female fitting to male fitting and push together until garter spring snaps over flared end of female fitting.

(7) Install the accumulator/drier hose and secure with locknut (Fig. 9).

(8) Connect the negative battery cable.

(9) Leak test, evacuate and charge the system as described in this section.

BLOWER MOTOR RESISTORS

The blower motor resistors are located on the bottom of the heater/A/C housing on the passenger side.

(1) Remove ECU mounting screws and lower the ECU.

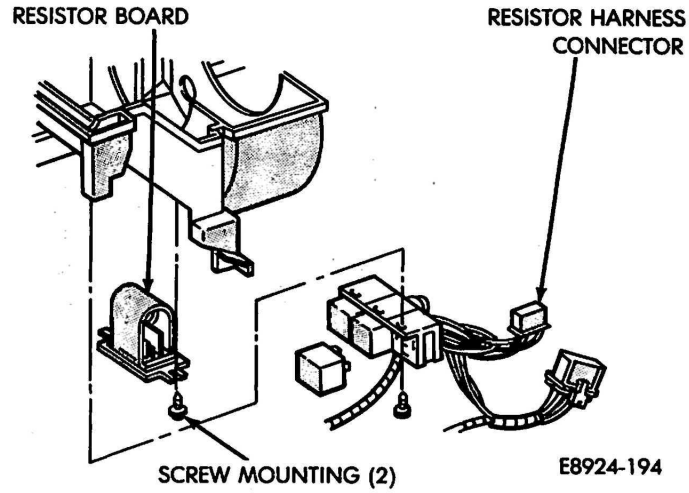


Fig. 11—Resistor Board Removal/Installation

(2) Remove resistor board mounting screws (Fig. 11).

(3) Disconnect the resistor harness connector and remove the resistor board.

To install resistor board, reverse the removal procedures (B).

CONDENSER TO EVAPORATOR HOSE

Removal

(1) Disconnect the battery negative cable.

(2) Discharge the A/C system.

(3) Disconnect the lower line (Fig. 12) at the condenser using the appropriate tool.

(4) Disconnect fixed orifice line (Fig. 13) at the dash panel using the appropriate tool.

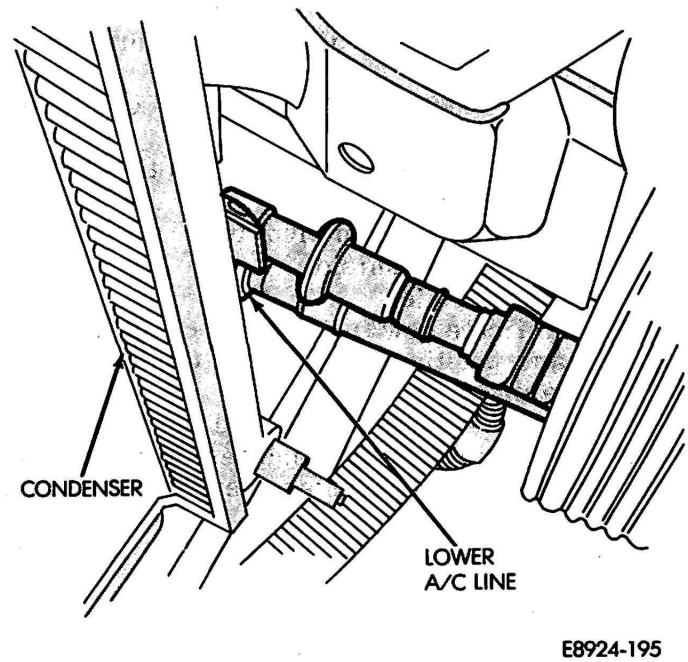


Fig. 12—Disconnect Lower A/C Line

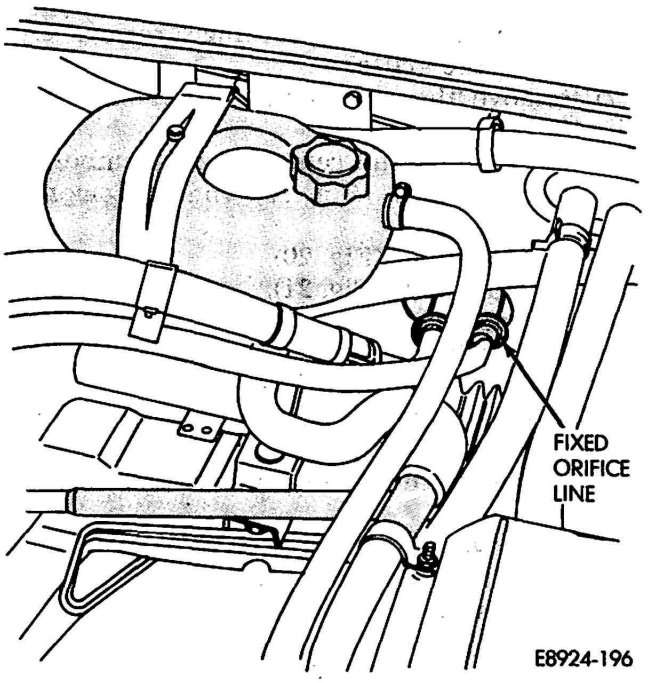


Fig. 13—Disconnect Fixed Orifice Line

(5) Unsnap anchors located on frame member and remove line from anchors.
(6) Remove line from vehicle.

Installation

(1) Lubricate all O-rings and the inside of the female fittings with clean refrigerant oil.
(2) Position condenser to evaporator line and install line into anchors located on frame member.
(3) Press each end of the line into its connector until it snaps into place.
(4) Connect the battery negative cable.
(5) Evacuate, charge and test the A/C system for leaks as described in this chapter.

FIXED ORIFICE TUBE

Removal

(1) Remove the condenser to evaporator hose as described in Condenser To Evaporator Hose Removal.
(2) Insert the appropriate tool (Fig. 14) from MS 1979 into the liquid line.
(3) Turn tool clockwise to engage tabs on orifice tube.
(4) Remove tool and orifice tube from liquid line.

Installation

(1) Position orifice tube tabs into installation tool.
(2) Slide orifice/tool assembly into liquid line until the orifice tube encounters indentations in liquid line (when tool fully stops against liquid line).
(3) Remove tool.
(4) Install liquid line as described in Condenser To Evaporator Line Installation.

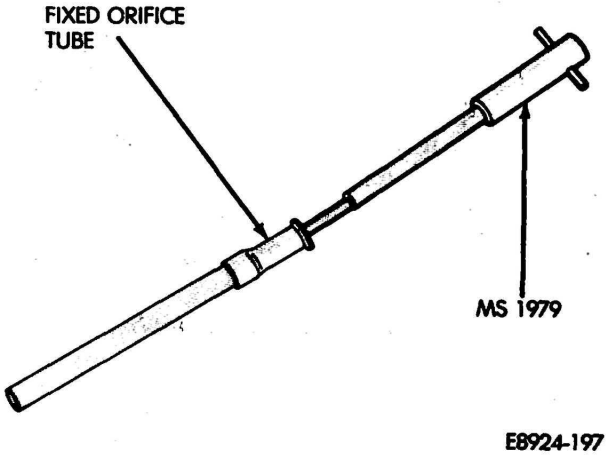


Fig. 14—Fixed Orifice Tube Removal/Installation

COMPRESSOR MANIFOLD HOSE

Removal

(1) Disconnect negative battery cable.
(2) Discharge the A/C system.
(3) Remove bolt (Fig. 15) attaching manifold to the compressor.
(4) Using appropriate tool from MS 1979 remove hose from condenser.
(5) Loosen locknut (Fig. 16) at the accumulator and remove the hose assembly.

Installation

(1) Lubricate new O-rings with clean refrigerant oil and position them in the O-ring grooves of the manifold.
(2) Position the manifold to the compressor and secure with bolt (Fig. 15). Tighten bolt to 37 N·m (28 ft lbs).
(3) Clean all dirt or foreign material from both pieces of the coupling.
(4) Install new O-rings on condenser to evaporator line male fittings. Lubricate all O-rings and the inside of the female fittings with clean refrigerant oil.
(5) Press the condenser end of the line onto its connector until it snaps into place.
(6) Fit hose to accumulator and tighten locknut (Fig. 16).
(7) Connect the battery negative cable.

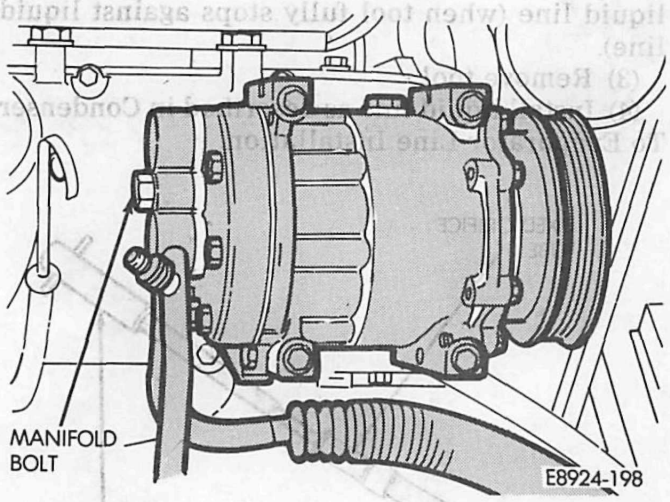


Fig. 15—Remove Manifold Attaching Bolt

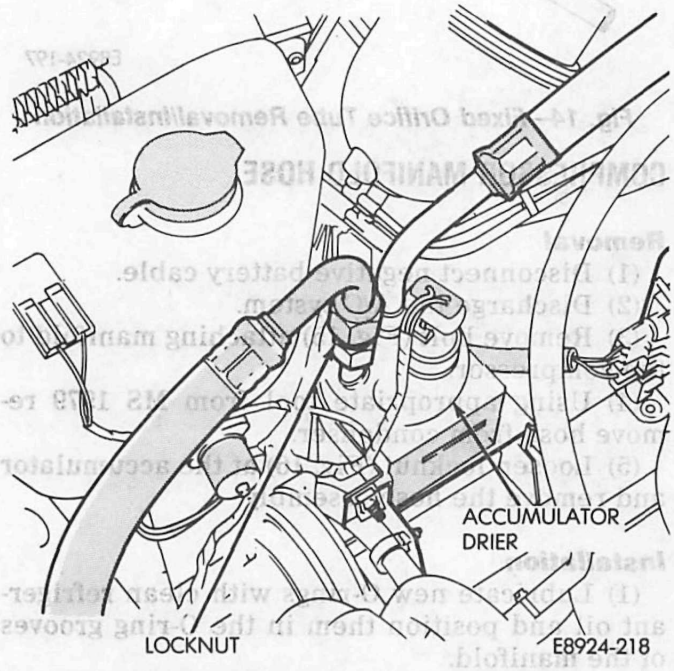


Fig. 16—Loosen Locknut

CONDENSER

Removal

(1) Attach one end of a 24 inch long, 1/4 inch I.D. hose to the radiator drain. Place the other end into a clean container.

When servicing the cooling system, care must be taken to ensure that coolant does not contact the accessory drive belt or pulleys. Cover the belt and pulleys with shop towels prior to servicing the cooling system.

(2) Remove the coolant expansion bottle cap.

(3) Open radiator drain and allow the radiator to drain.

(4) Disconnect the upper and lower radiator hoses.

(5) Discharge the A/C system.

(6) Remove the grille retaining screws (Fig. 17) and remove the grille.

(7) Remove the crossmember attaching bolts (Fig. 18).

(8) Loosen nuts and remove crossmember.

(9) Remove bolts (Fig. 19) and crossmember brace.

(10) Remove bolt (Fig. 20).

(11) Remove bolt (Fig. 21).

(12) Disconnect coolant temperature switch connector (Fig. 22) and fan power connector.

(13) Using the appropriate tool from MS 1979 kit, disconnect the refrigerant lines at the condenser hose connections.

(14) Remove the fan/radiator/condenser assembly.

(15) Remove screws (Fig. 23) and separate the condenser from the fan/radiator.

(16) Remove side seals.

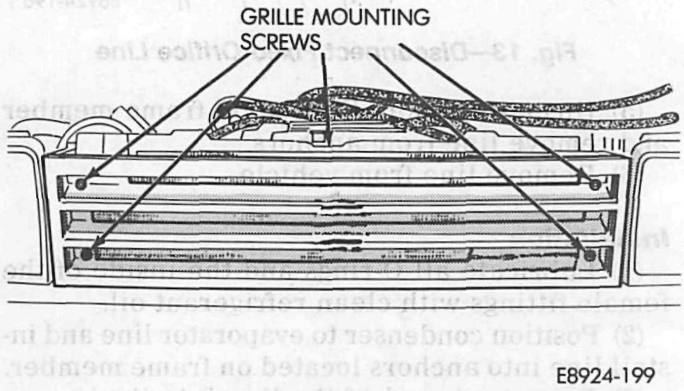


Fig. 17—Grille Removal/Installation

Installation

CAUTION: Failure to maintain the correct oil level in the system will cause compressor failure. Too much oil in the system will decrease system efficiency and possibly cause system noise.

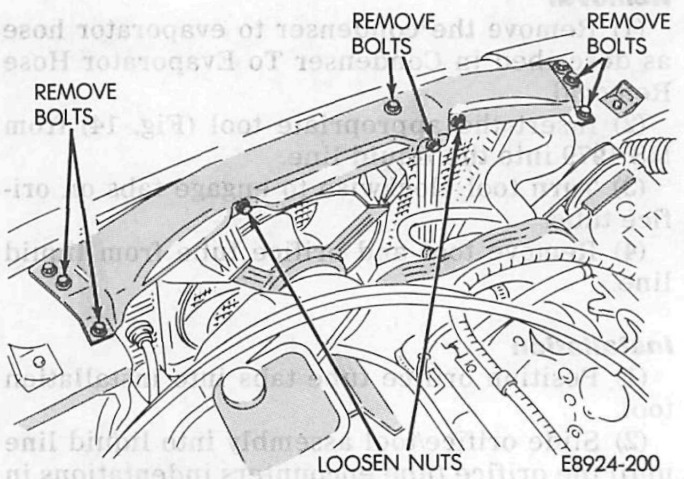


Fig. 18—Radiator Crossmember Removal/Installation

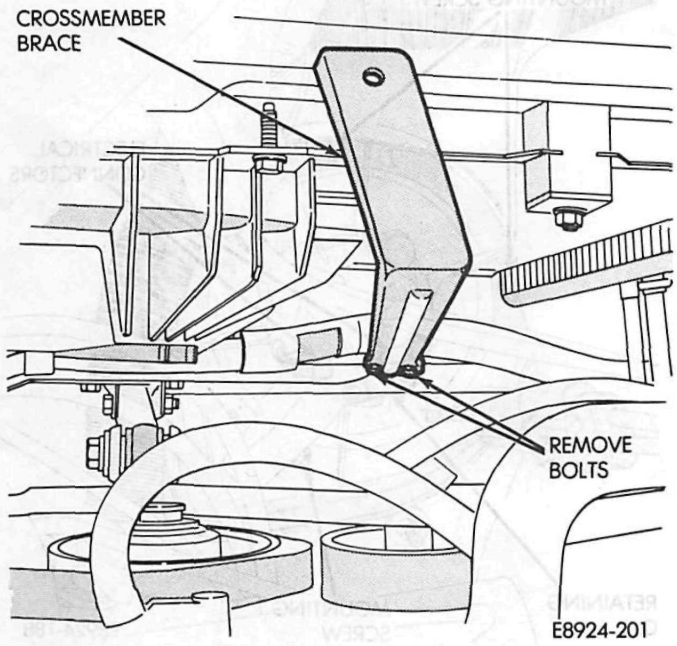


Fig. 19—Remove Crossmember Brace

Add 29.57 ml (1 fluid oz) of clean refrigerant oil to the condenser or the accumulator/drier if the condenser is replaced.

(1) Attach the condenser to the fan/radiator assembly with screws (Fig. 23).

(2) Install side seals to new condenser.

(3) Install the fan/radiator/condenser assembly using bolts (Figs. 20, 21).

(4) Connect the coolant temperature switch and fan power connector.

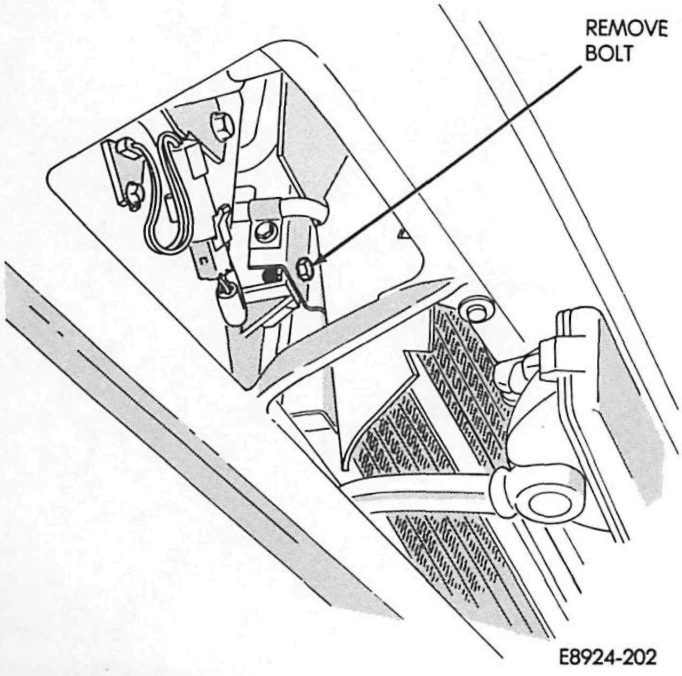


Fig. 20—Remove Bolt

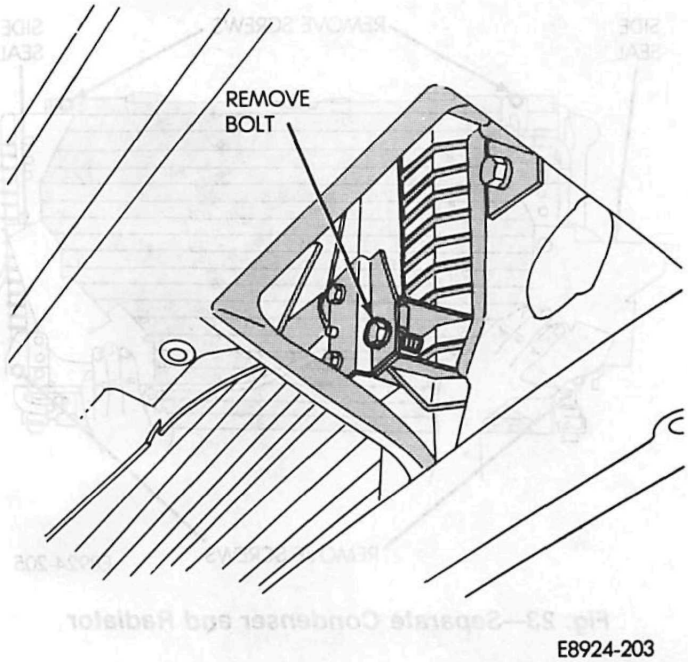


Fig. 21—Remove Bolt

(5) Install crossmember brace with bolts (Fig. 19).

(6) Connect the upper and lower radiator hoses.

(7) Install crossmember with bolts (Fig. 18) and tighten nuts.

(8) Install grille with screws (Fig. 17).

(9) Close radiator drain and fill radiator. Refer to Engine Cooling System-Filling Procedures (Group 7).

(10) Charge the A/C system as described in this chapter.

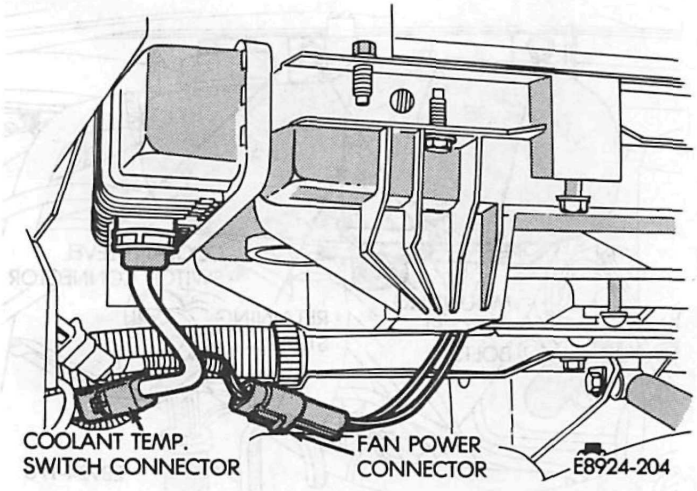


Fig. 22—Disconnect Electrical Connectors

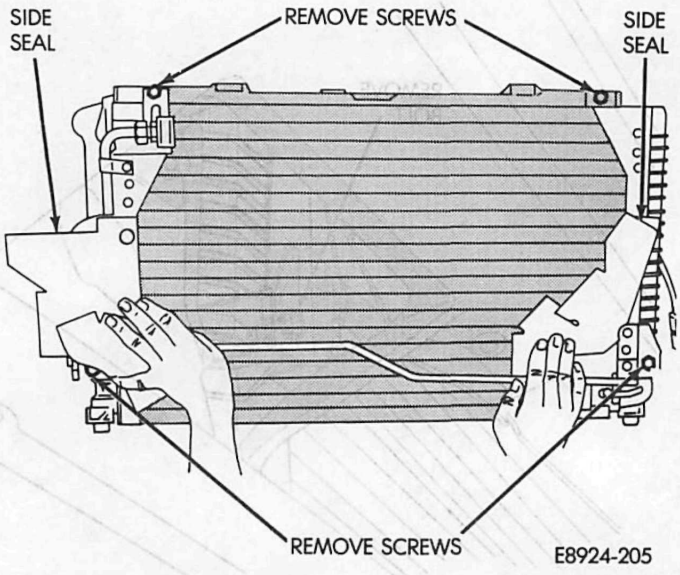


Fig. 23—Separate Condenser and Radiator

BLOWER MOTOR

(1) Disconnect coolant level switch connector (Fig. 24).

(2) Remove coolant reservoir retaining strap and move reservoir aside.

(3) Remove coolant reservoir mounting bracket bolts and remove bracket.

(4) Pry off retaining clip (Fig. 25) and disconnect wires from blower motor.

(5) Remove blower motor mounting screws and remove blower motor.

To install blower motor, reverse the removal procedures.

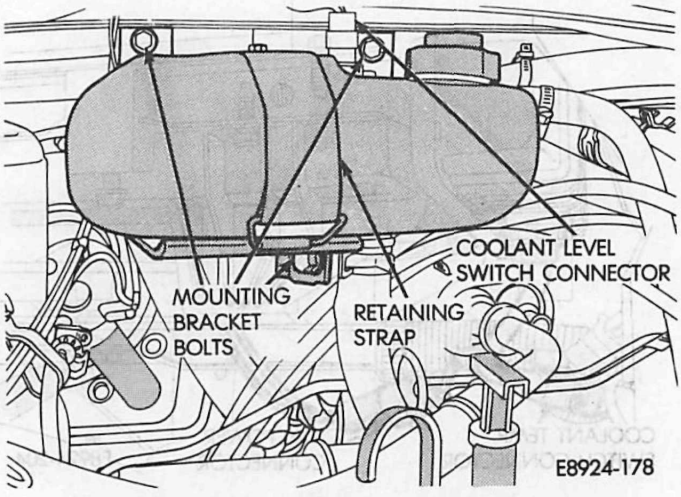


Fig. 24—Coolant Bottle Removal/Installation

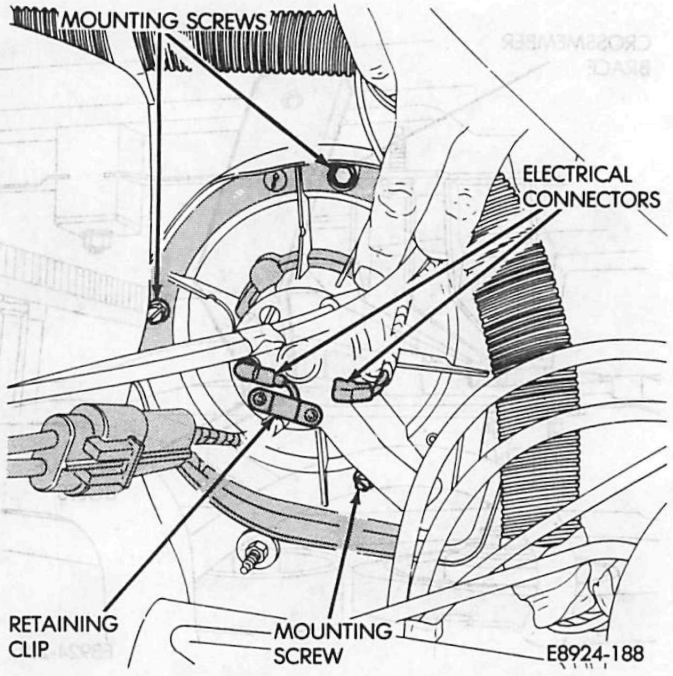


Fig. 25—Blower Motor Removal/Installation

COMPRESSOR OVERHAUL

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COMPRESSOR CLUTCH

Removal

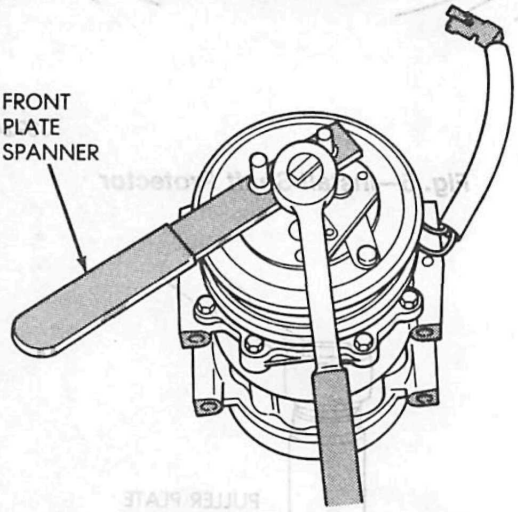
(1) Insert the two pins of the front plate spanner into any two threaded holes of the clutch front plate (Fig. 1). Hold clutch plate stationary. Remove hex nut with 19mm (3/4 in.) socket.

(2) Remove clutch front plate using puller. Align puller center bolt to compressor shaft (Fig. 2). Thumb tighten the three puller bolts into the threaded holes.

(3) Turn center bolt clockwise with 19mm (3/4 in) socket until front plate is loosened.

(4) Remove shaft key by lightly tapping it loose with a slot screw driver and hammer (Fig. 3).

(5) Remove the external front housing snap ring by using spread type snap ring pliers (Fig. 4).



J8924-17

Fig. 1—Remove Hex Nut

(6) Insert the lip of the jaws of the rotor puller into the snap ring groove exposed in the previous step (Fig. 5).

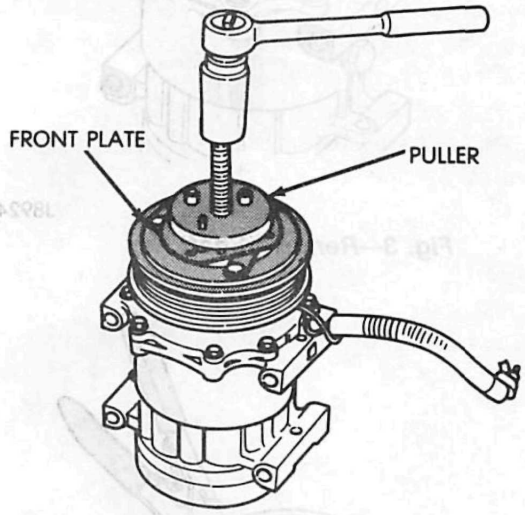
(7) Place rotor puller shaft protector over the exposed shaft.

(8) Install the puller plate and bolt (Fig. 6). Two bolts go through the plate and into the jaws. Finger tighten bolts.

(9) Turn puller center bolt clockwise using 3/4 inch socket until rotor pulley is free.

(10) Loosen coil lead wire from clip on top of compressor front housing (Fig. 7).

(11) Using spread type snap ring pliers, remove snap ring and field coil (Fig. 8).



J8924-18

Fig. 2—Remove Clutch Front Plate

Installation

(1) Install the field coil with the snap ring.

(2) Place coil lead wire under clip on top of compressor front housing and tighten the retaining screw.

(3) Support the compressor on the four mounting ears at the compressor rear. If a vise is being used, clamp only on the mounting ears. Never on the compressor body.

(4) Align rotor assembly squarely on the front housing hub.

(5) Using Rotor Installer Set, place the ring part of the set into the bearing cavity (Fig. 9). Make certain the outer edge rests firmly on the rotor bearing inner race.

(6) Place the tool set driver into the ring as shown (Fig. 10).

(7) With a hammer, tap the end of the driver while guiding the rotor to prevent binding. Tap until the rotor bottoms against the compressor front housing hub. Listen for a distinct change of sound during the tapping process.

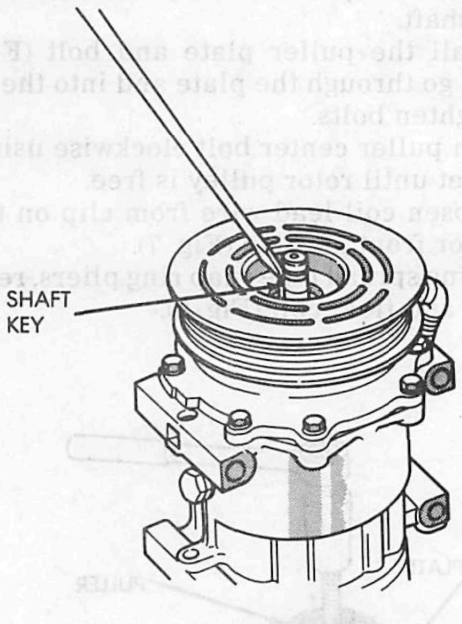


Fig. 3—Remove Shaft Key

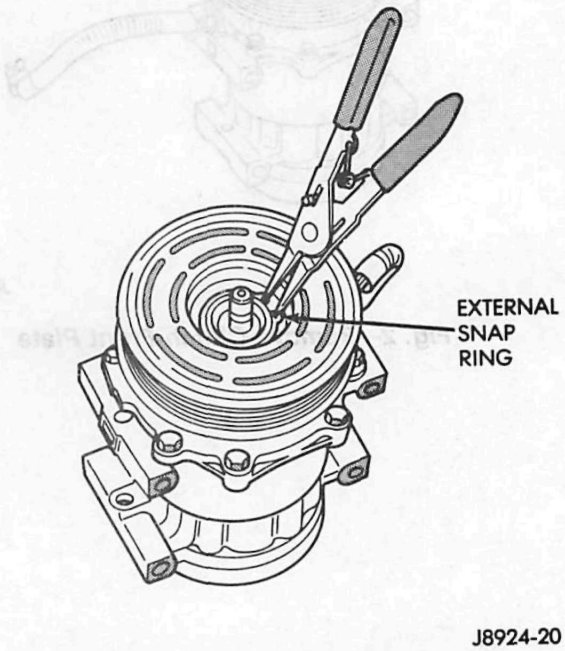


Fig. 4—Remove External Snap Ring

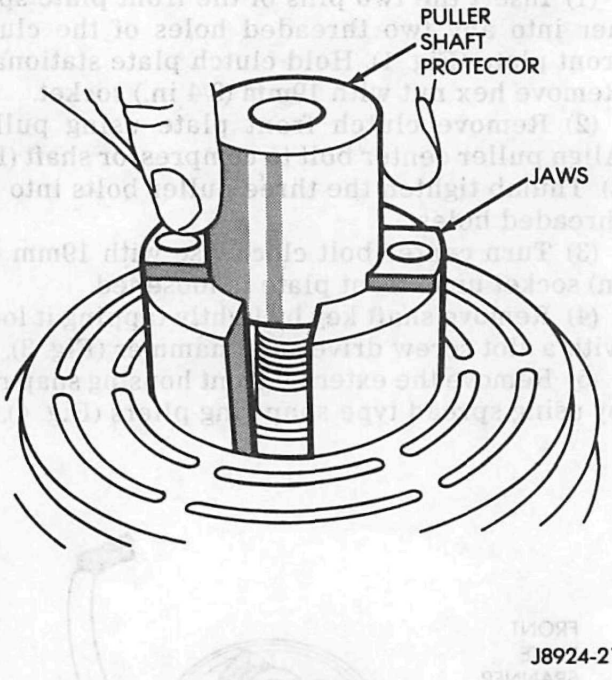


Fig. 5—Install Shaft Protector

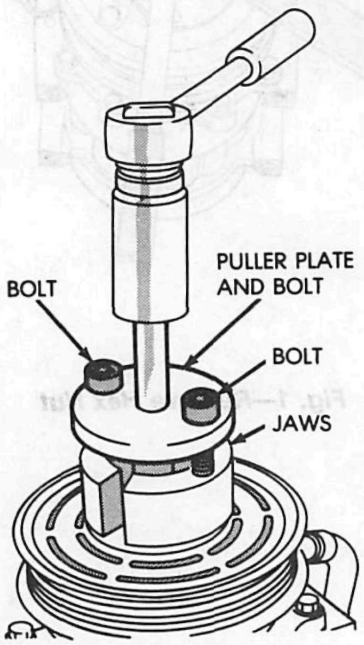


Fig. 6—Install Puller Plate

(8) Install external front housing snap ring with spread type snap ring pliers.

(9) Install front plate assembly.

- Check that original clutch shims are in place on compressor shaft.
- Replace compressor shaft key.
- Align front plate keyway to compressor shaft key.

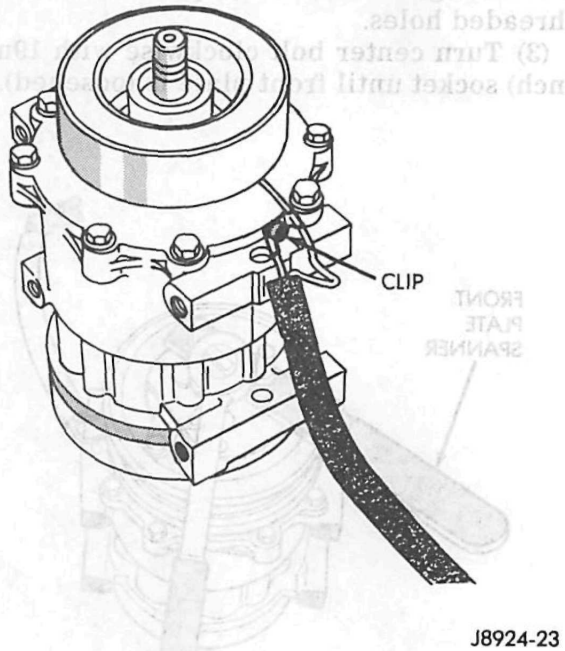


Fig. 7—Loosen Coil Lead Wire

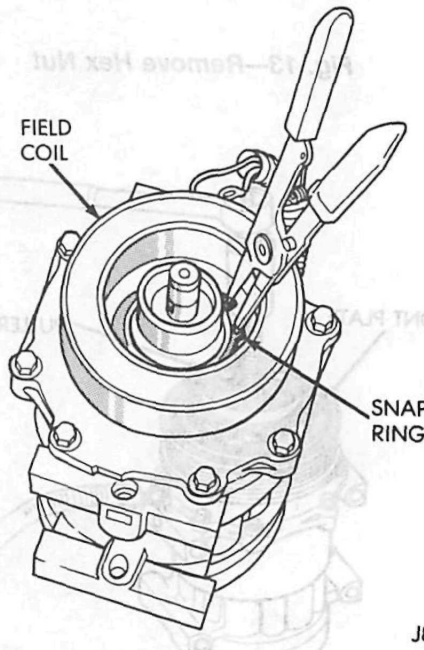


Fig. 8—Remove Snap Ring and Field Coil

(10) Using Shaft Protector, tap front plate to shaft until it has bottomed to the clutch shims (Fig. 11). Listen for a distinct change of sound during the tapping process.

(11) Replace shaft hex nut. Torque to 34-40 N·m (25-30 ft lbs).

(12) Check air gap with feeler gauge to 0.016 to 0.031 inch. If air gap is not consistent around the circumference, lightly pry up at the minimum variations (Fig. 12). Lightly tap down at points of maximum variation.



Fig. 9—Install Rotor Installer Set

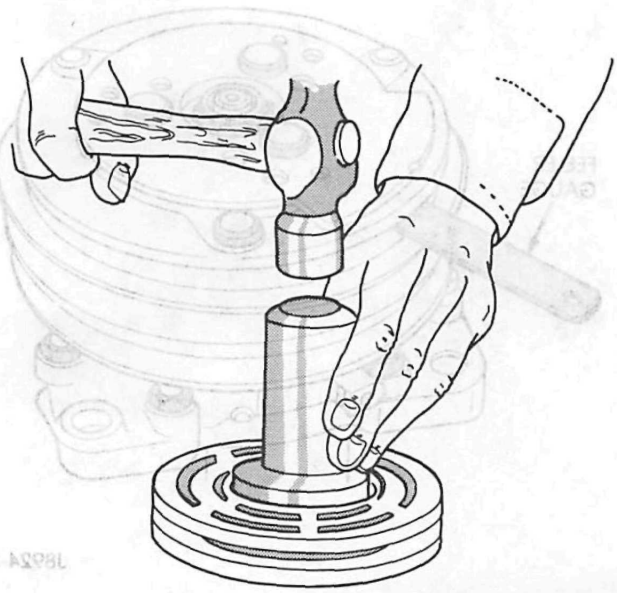


Fig. 10—Install Rotor

The air gap is determined by the spacer shims. When reinstalling or installing a new clutch assembly, try the original shims first. When installing a new clutch onto a compressor that previously did not have a clutch, use 0.040, 0.020, and 0.005 shims from the clutch accessory sack.

(13) If the air gap does not meet the specification given, add or subtract shims as required.

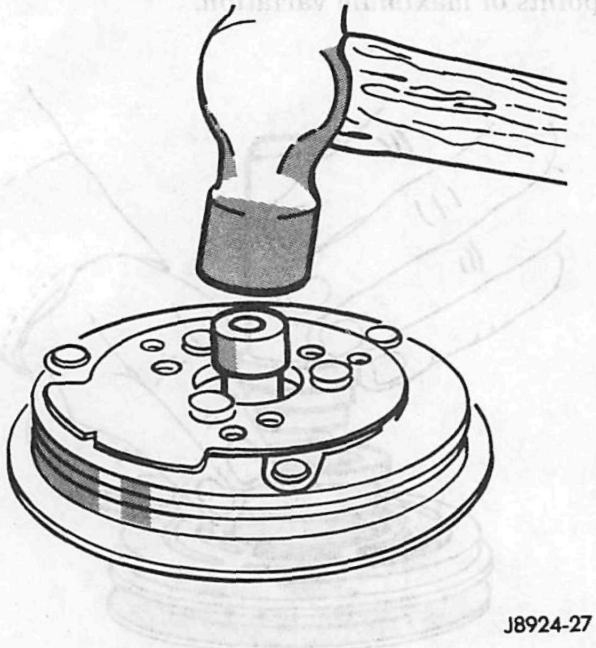


Fig. 11—Install Front Plate to Shaft

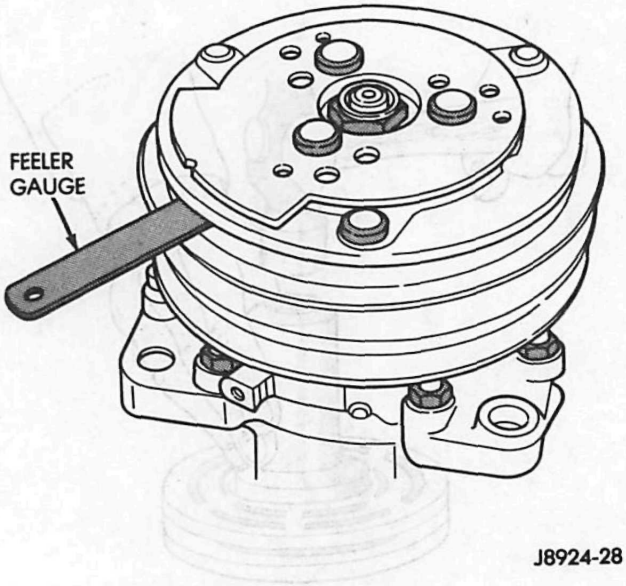


Fig. 12—Check Air Gap

COMPRESSOR SHAFT SEAL

Removal

(1) Insert the two pins of the front plate spanner into any two threaded holes of the clutch front plate (Fig. 13). Hold clutch plate stationary. Remove hex nut with 19 mm (3/4 inch) socket.

(2) Remove clutch front plate using puller (Fig. 14). Align puller center bolt to compressor shaft. Thumb tighten the three puller bolts into the threaded holes.

(3) Turn center bolt clockwise with 19mm (3/4 inch) socket until front plate is loosened).

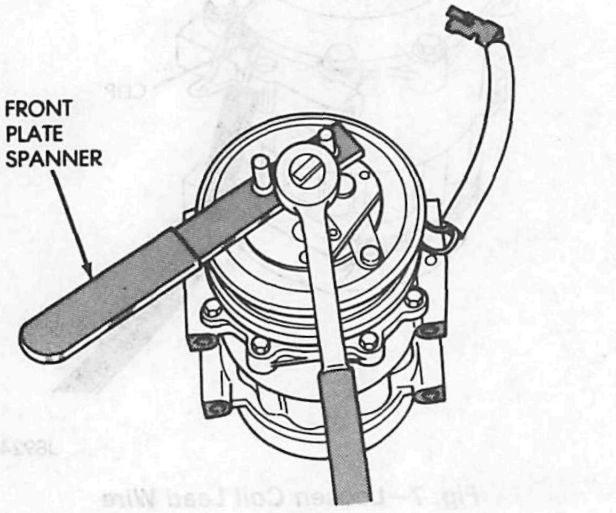


Fig. 13—Remove Hex Nut

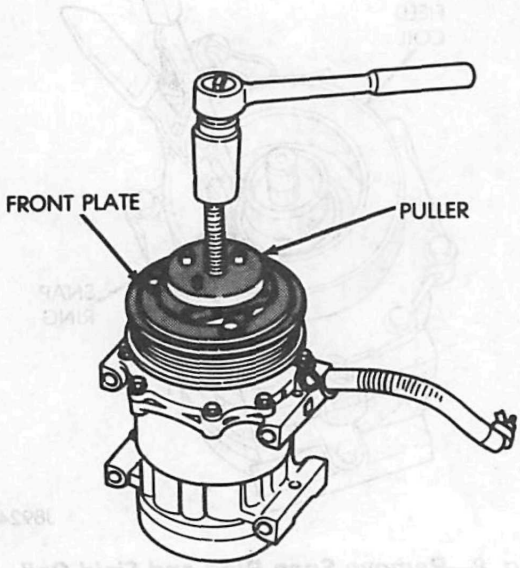


Fig. 14—Remove Clutch Front Plate

Shaft seal replacement should be done on the bench. Never use any old parts of the shaft seal assembly. Rebuild the complete assembly.

(4) Using either of the snap ring tools, insert the tool points into the two holes of the felt ring metal retainer and lift out the felt ring (Fig. 15).

(5) Remove the clutch shim. Use O-ring hook and a small screwdriver to prevent shim from binding on shaft (Fig. 16).

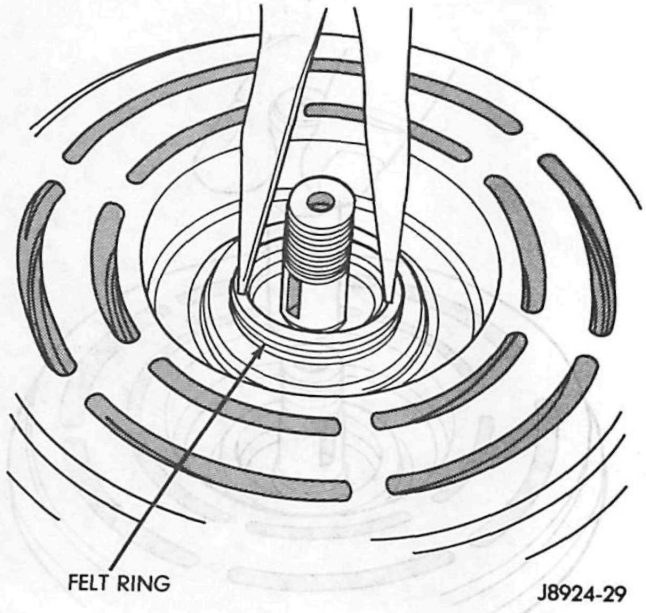


Fig. 15—Remove Felt Ring

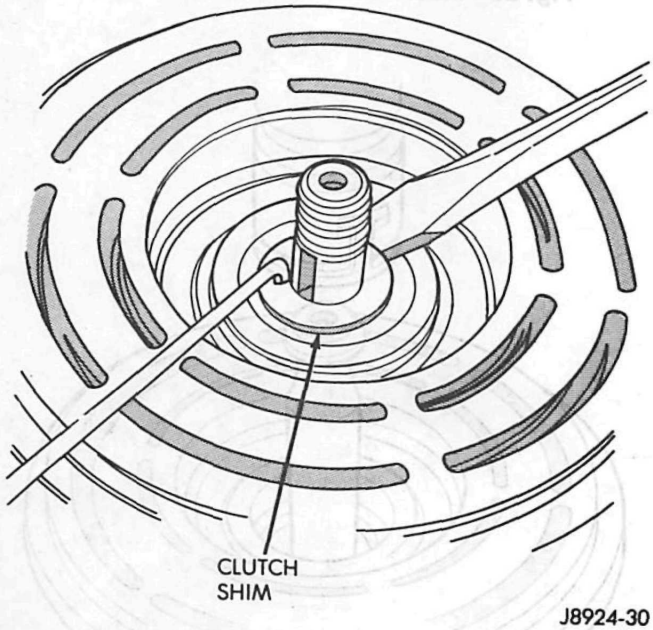


Fig. 16—Remove Clutch Shim

(6) Remove shaft seal seat retaining snap ring with pinch type snap ring pliers (Fig. 17).

(7) Remove the shaft seal seat, using seal seat tool (Fig. 18).

(8) Insert the Seal Remover and Installer Tool against the seal assembly. Press down against the seal spring and twist the tool until it engages the slots of the seal cage (Fig. 19). Lift out seal assembly.

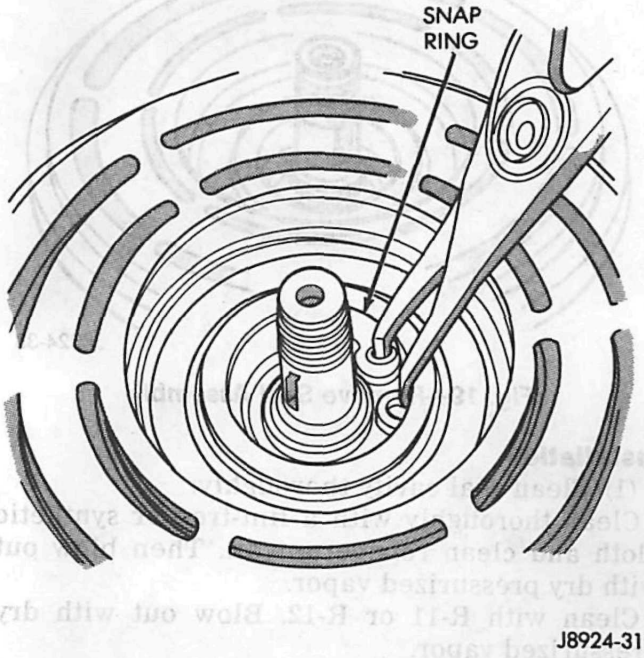


Fig. 17—Remove Snap Ring

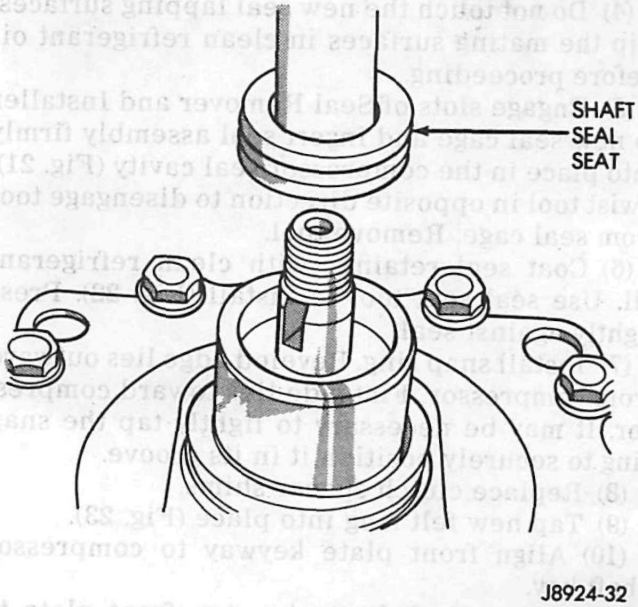


Fig. 18—Remove Shaft Seal Seat

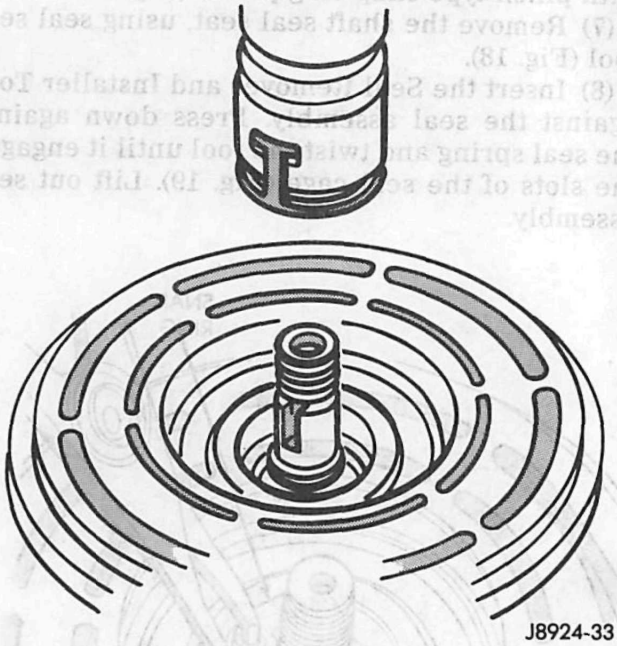


Fig. 19—Remove Seal Assembly

Installation

(1) Clean seal cavity thoroughly:

- Clean thoroughly with a lint-free or synthetic cloth and clean refrigerant oil. Then blow out with dry pressurized vapor.
- Clean with R-11 or R-12. Blow out with dry pressurized vapor.

(2) Make sure all foreign substances are thoroughly removed.

(3) Insert Seal Sleeve Protector over compressor shaft (Fig. 20).

(4) Do not touch the new seal lapping surfaces. Dip the mating surfaces in clean refrigerant oil before proceeding.

(5) Engage slots of Seal Remover and Installer to new seal cage and insert seal assembly firmly into place in the compressor seal cavity (Fig. 21). Twist tool in opposite direction to disengage tool from seal cage. Remove tool.

(6) Coat seal retainer with clean refrigerant oil. Use seal seat tool to install (Fig. 22). Press lightly against seal.

(7) Install snap ring. Beveled edge lies outward from compressor. Flat side lies toward compressor. It may be necessary to lightly tap the snap ring to securely position it in its groove.

(8) Replace clutch spacer shims.

(9) Tap new felt ring into place (Fig. 23).

(10) Align front plate keyway to compressor shaft key.

(11) Using Shaft Protector, tap front plate to shaft until it has bottomed to the clutch shims (Fig. 24). Listen for a distinct change of sound during the tapping process.

(12) Replace shaft hex nut. Torque to 34-40 N·m (25-30 ft lbs).

(13) Check air gap with feeler gauge to 0.016 to 0.032 inch. If air gap is not consistent around the circumference, lightly pry up at the minimum variations (Fig. 25). Lightly tap down at points of maximum variation.

The air gap is determined by the spacer shims. When reinstalling or installing a new clutch assembly, try the original shims first. When install-



Fig. 20—Insert Seal Sleeve Protector

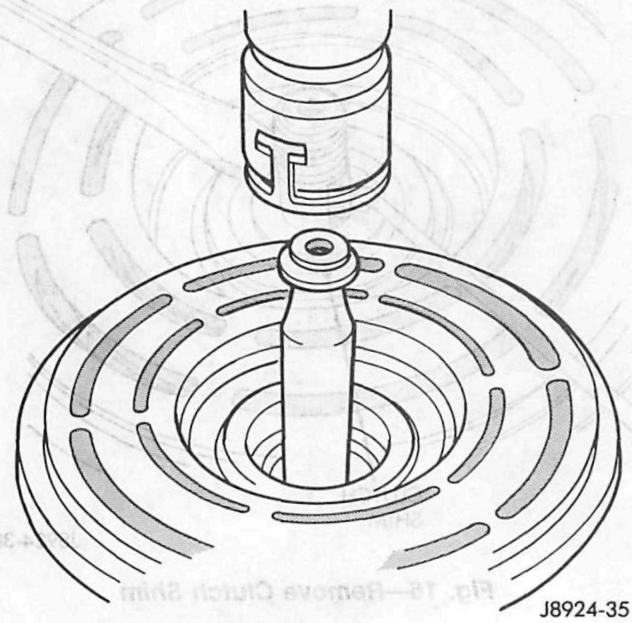


Fig. 21—Install Seal Assembly

ing a new clutch onto a compressor that previously did not have a clutch, use 0.040, 0.020, and 0.005 shims from the clutch accessory sack.

If the air gap does not meet the specification given, add or subtract shims as required.

CYLINDER HEAD/VALVE PLATE

Removal

(1) Remove cylinder head cap screws (Fig. 26).

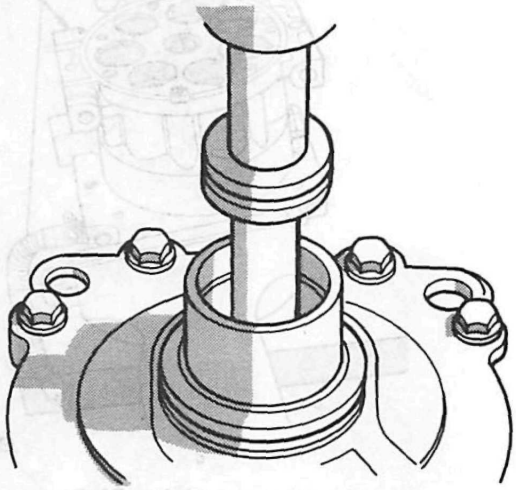
(2) Using a small hammer and a gasket scraper separate the cylinder head from the valve plate (Fig. 27).

(3) Visually inspect all parts for damage.

(4) Separate the valve plate from the cylinder block (Fig. 28).

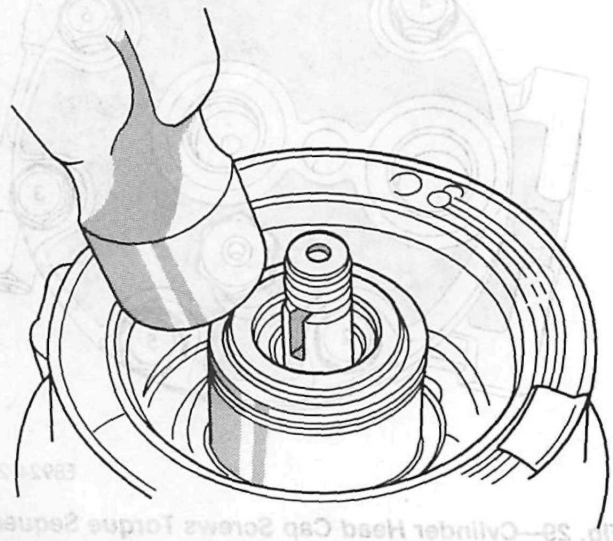
(5) Visually inspect the rear valves and discharge retainer for damage. Discard any component if any portion is damaged.

If valve plate and/or cylinder head are to be reused, carefully remove gasket materials using the gasket scraper. Do not damage cylinder block or valve plate surfaces.



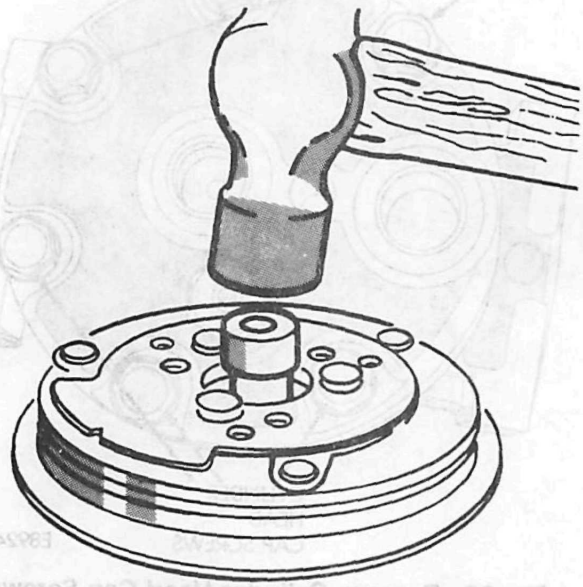
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Fig. 22—Install Seal Retainer



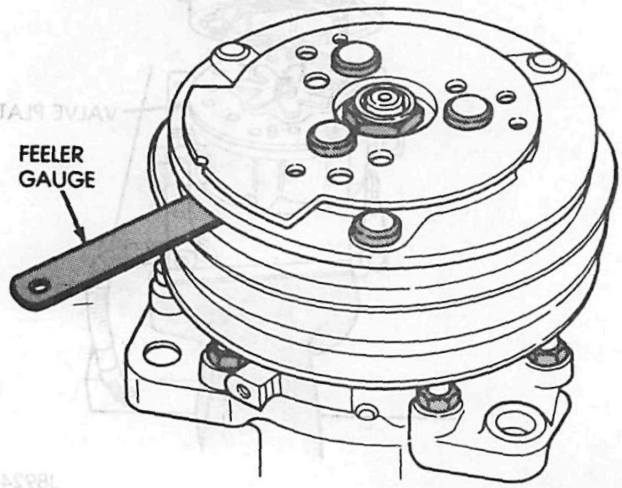
J8924-37

Fig. 23—Install New Felt Ring



J8924-27

Fig. 24—Install Front Plate to Shaft



J8924-28

Fig. 25—Check Air Gap

Installation

When installing the cylinder head valve plate, use the new gaskets in the parts kit.

(1) Coat new valve plate gasket with clean refrigerant oil.

(2) Install valve plate gasket by aligning valve plate gasket to locating pin holes and oil orifice in cylinder block. (For easy reference, the gaskets have a notch at the bottom outside edge).

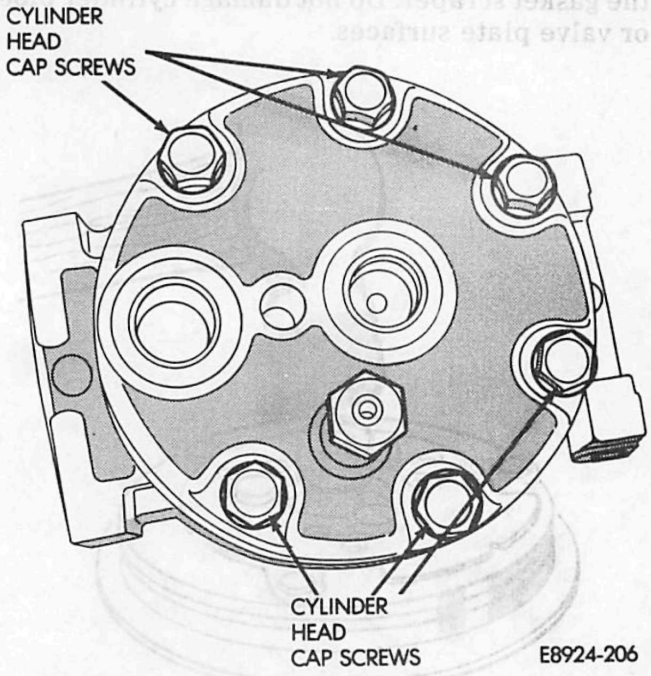


Fig. 26—Remove Cylinder Head Cap Screws

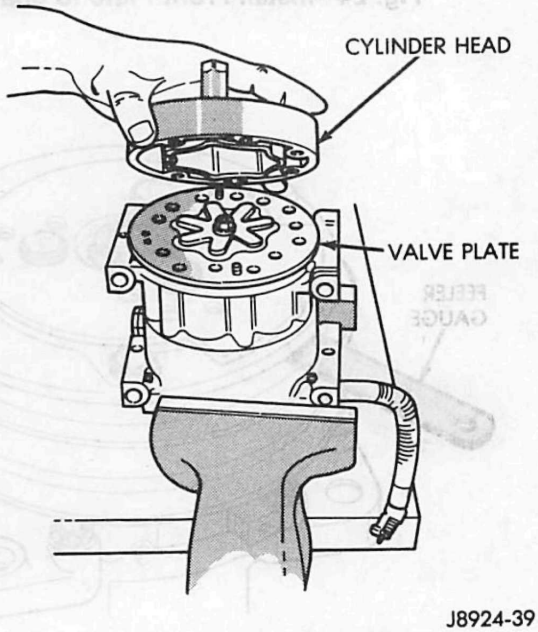


Fig. 27—Remove Cylinder Head

(3) Install valve plate by aligning valve plate locating pins to the pin holes in the block and position valve plate.

(4) Install cylinder head and tighten cap screws to 30-33 N·m (22-25 ft-lbs) in the order shown (Fig. 29).

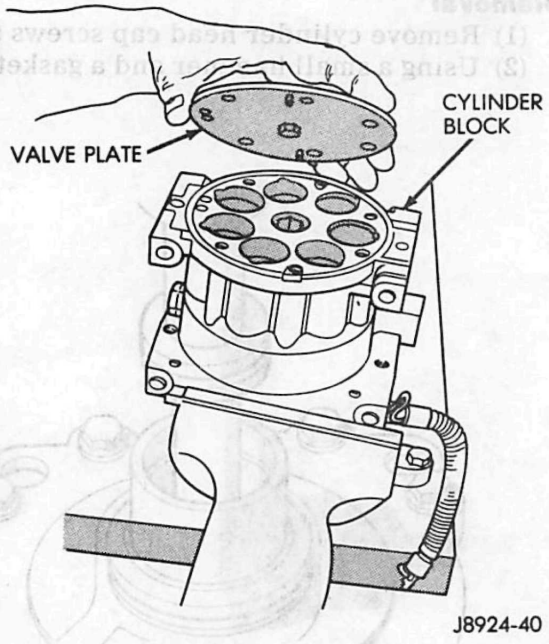


Fig. 28—Remove Valve Plate

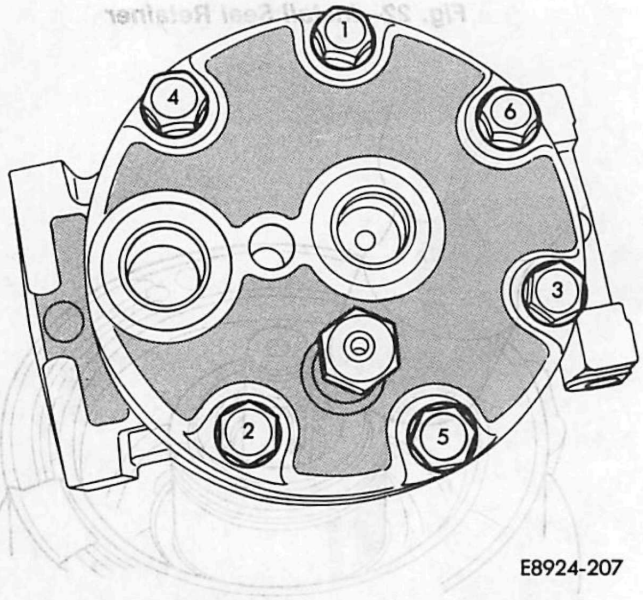


Fig. 29—Cylinder Head Cap Screws Torque Sequence

OIL LEVEL FILLING AND CHECKING PROCEDURES

Whenever a system component has been replaced or there is an obvious oil leak, perform the following procedures after repairs have been made.

It is not necessary to check the oil level as routine maintenance. However, should there be good reason to suspect an incorrect oil level, such as an obvious oil leak, or it is specified in a diagnosis procedure to check the oil, follow these steps:

- Charge refrigerant.
- The amount of oil that the compressor will recover will vary to the compressor speed, as shown in the following table.

MOUNTING ANGLE/DEGREE	ACCEPTABLE OIL LEVEL IN INCREMENTS
0	6-8
10	7-8
20	8-10
30	9-10
40	11-12
50	12-13
60	13-14
90	15-16

E8924-209

- Maintain the compressor at one of the speeds (preceding table) for 10 to 15 minutes.
- Shut off A/C system keeping the throttle pedal position to the selected speed and then quickly turn off the engine.
- Recover all Refrigerant 12 from the system. Be careful not to lose oil.

The preferred method to check the oil level is to remove the compressor from the vehicle and check the oil level at the bench. On vehicle checking is possible but it is not the most accurate.

(1) Determine the mounting angle. Position an Angle Gauge across the flat surfaces of the two front mounting ears. Center the bubble. Read the mounting angle to the closest degree.

(2) Remove the oil filler plug. Look through the oil filler plug hole and rotate the clutch front plate to position the internal parts as shown (Fig. 30). This step is necessary to clear the dipstick of internal parts and allow its insertion to full depth.

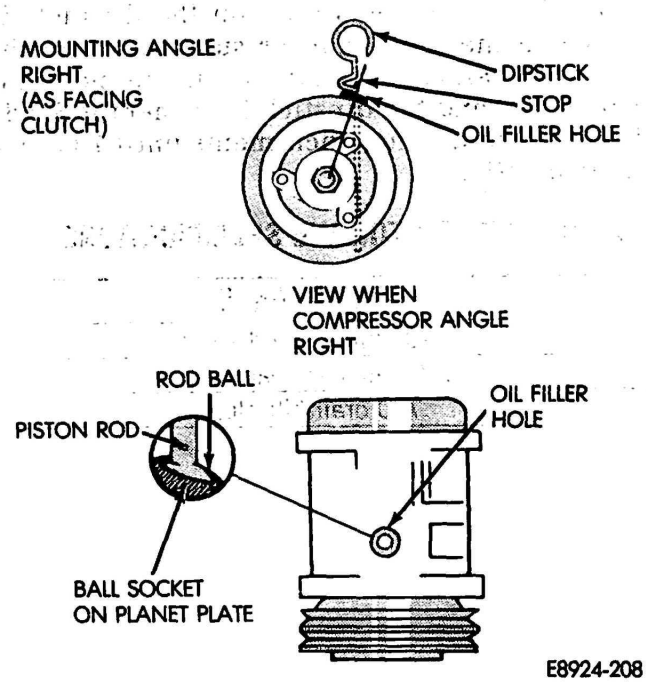


Fig. 30—Oil Level Checking

(3) Insert the dipstick to its STOP position. The stop is the angle near the top of the dipstick. The bottom surface of the angle must be flush with the surface of the oil filler hole.

(4) Remove dipstick. Count increments of oil.

(5) Use mounting angle table to determine correct oil level for the compressor.

COMPRESSOR RPM	QUANTITY OF OIL TO BE FOUND IN COMPRESSOR AFTER 10 TO 15 MINUTES FL. OZ.	CC
1000	3.4	100
2000	2.5	75
3000	1.7	50
4000	1.35	40
5000	1.2	35

E8924-210

(6) If the increments read on the dipstick do not match the table, add or subtract oil to the mid-range value. For example, if the mounting angle is 10°, and the dipstick increment is 3, add oil in one fluid ounce increments until 7 is read on the dipstick.

(7) Check that the sealing O-ring is not twisted.

(8) Seat and O-ring must be clean.

(9) Install oil filler plug. Torque plug to 8-12 N·m (6-9 ft lbs). Do not overtighten the plug to stop a leak.

A/C COMPRESSOR TORQUE SPECIFICATIONS

COMPONENTS	TORQUE
A/C clutch spindle nut	34-40 N·m (25-30 ft lbs)
A/C cylinder head bolts	30-34 N·m (22-25 ft lbs)
A/C drain/fill plug	8-12 N·m (6-9 ft lbs)

EMISSION CONTROL SYSTEMS

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EVAPORATIVE EMISSION CONTROLS

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GENERAL INFORMATION

Vehicle Emissions Control Information Label

All vehicles are equipped with a Vehicle Emission Control Information label (Fig. 1 and Fig. 2). The label, which is located in the engine compartment, lists the vehicles' engine family and displacement, evaporative family, emission control system, certification application, engine timing specifications, idle speeds (if adjustable), and spark plug gap. If any differences occur between the information on the Vehicle Emission Control Information label and the service manual, the information on the label should be used.

The label shown (Fig. 2) is for vacuum hose routing information only.

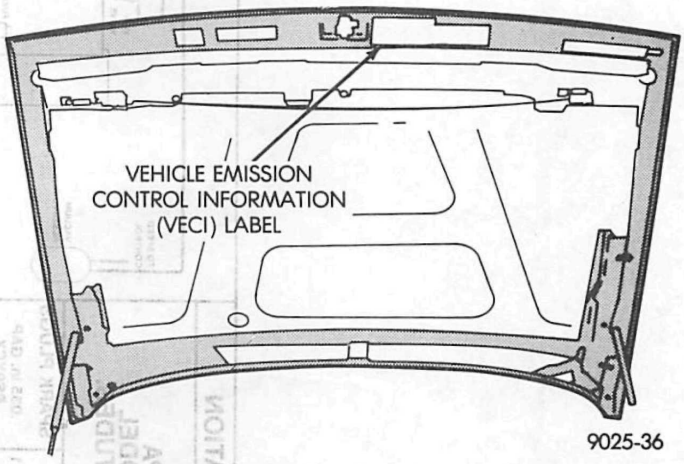


Fig. 1—Underhood Label Location

JEEP EAGLE CORPORATION

5980BTCD

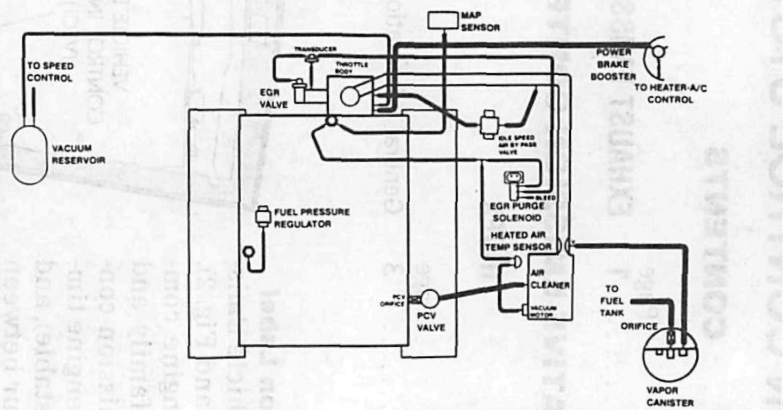
For Position Only

VEHICLE EMISSION CONTROL INFORMATION

THIS VEHICLE CONFORMS TO U.S. EPA REGULATIONS APPLICABLE TO 1990 MODEL YEAR NEW MOTOR VEHICLES AT ALL ALTITUDES.

	3.0 LITER	SPARK PLUGS
* BASIC IGNITION TIMING AND IDLE FUEL/AIR MIXTURE HAVE BEEN PRESET AT THE FACTORY. SEE THE SERVICE MANUAL FOR PROPER PROCEDURES AND OTHER ADDITIONAL INFORMATION.	LAM3.0V5LYE1 LV-3.0J-1P	.035 in. GAP RS9YCX
° ADJUSTMENTS MADE BY OTHER THAN APPROVED SERVICE MANUAL PROCEDURES MAY VIOLATE FEDERAL AND STATE LAWS. CAUTION: APPLY PARKING BRAKE WHEN SERVICING VEHICLE	NO ADJUSTMENTS NEEDED	

4405371 **CATALYST**



9025-37

Fig. 2—Vehicle Emission Control Information Label

EVAPORATION CONTROL SYSTEM

The evaporative emission control system prevents the release of unburned hydrocarbons, from liquid gasoline or gasoline vapor, into the atmosphere. When pressure in the fuel tank is below 21kPa (3psi), the rollover valves open allowing fuel vapors to flow to the evaporative canister where they are absorbed by a charcoal mixture. This prevents excessive pressure build-up in the fuel tank. Most canisters are equipped with a calibrated restrictor at the inlet to the canister. Refer to the appropriate vacuum hose routing schematic for restrictor size and location.

Fuel vapors stored in the canister are consumed in the combustion process during engine operation.

Canister Purge Function

The 3.0L engine utilizes a venturi in the air cleaner assembly as a purge line vacuum source (Fig. 3).

The effect of the venturi increases the speed of the intake air flowing by the purge inlet slots in the venturi wall. This creates a low pressure area at the inlet slots that draws vapors from the canister into the airstream flowing through the venturi (Fig. 4). The vapors pass through the intake manifold into the combustion chambers where they are consumed during combustion.

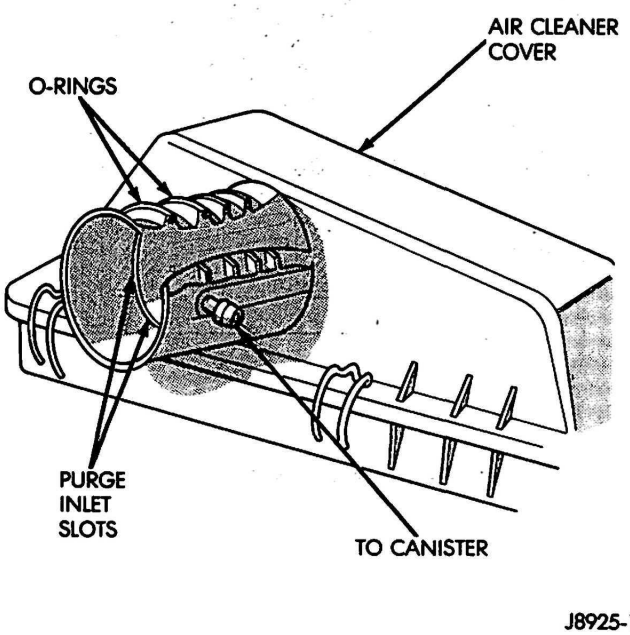


Fig. 3—Air Cleaner Venturi

Rollover Valve

The fuel tank is equipped with two rollover valves. The dual function valves relieve fuel tank pressure and prevent fuel flow through the fuel tank vent hoses in the event of vehicle rollover.

The valve consists of a plunger, spring, and an orifice and guide plate (Fig. 5). The valve is normally open. In the closed position, force applied by spring pressure seats the plunger against the guide plate, shutting off the flow of fuel vapor from the fuel tank to the evaporative canister. When fuel does not reach the valve, the spring pressure is overcome and the plunger moves away from the guide plate allowing fuel vapor to flow through the valve orifice.

In vehicle rollover the valve is inverted. In this position the plunger is forced against the guide plate and raw fuel is prevented from flowing through the valve orifice into the fuel tank vent tube.

Removal

(1) Disconnect battery negative cable from the battery.

(2) Remove the fuel filler cap and drain fuel tank. Refer to Draining Fuel Tank in Group 14.

(3) Remove fuel tank. Refer to Fuel Tank Removal in Group 14.

(4) The rollover valve is seated in a grommet. Remove by prying one side upward and then roll the grommet out of tank (Fig. 6).

Installation

(1) Start one side of grommet into opening in fuel tank and roll grommet into place. Using finger pressure only, press valve/grommet into place. A light coat of power steering fluid or a spray of silicon lubricant may be used to ease assembly.

(2) Install fuel tank. Refer to Fuel Tank Installation.

(3) Fill fuel tank. Install fuel tank filler cap.

(4) Connect battery negative cable to battery.

(5) Start vehicle and check for leaks.

Evaporative Canister

The evaporative canisters of Premier vehicles are filled with granules of an activated carbon mixture. Fuel vapors entering the canister are absorbed by the granules.

The evaporative canisters used on vehicles equipped with MPI (3.0L engine) have one inlet that is connected to the rollover valves of the fuel tank through fuel hose and tubes. The canister is connected to the air cleaner snorkel.

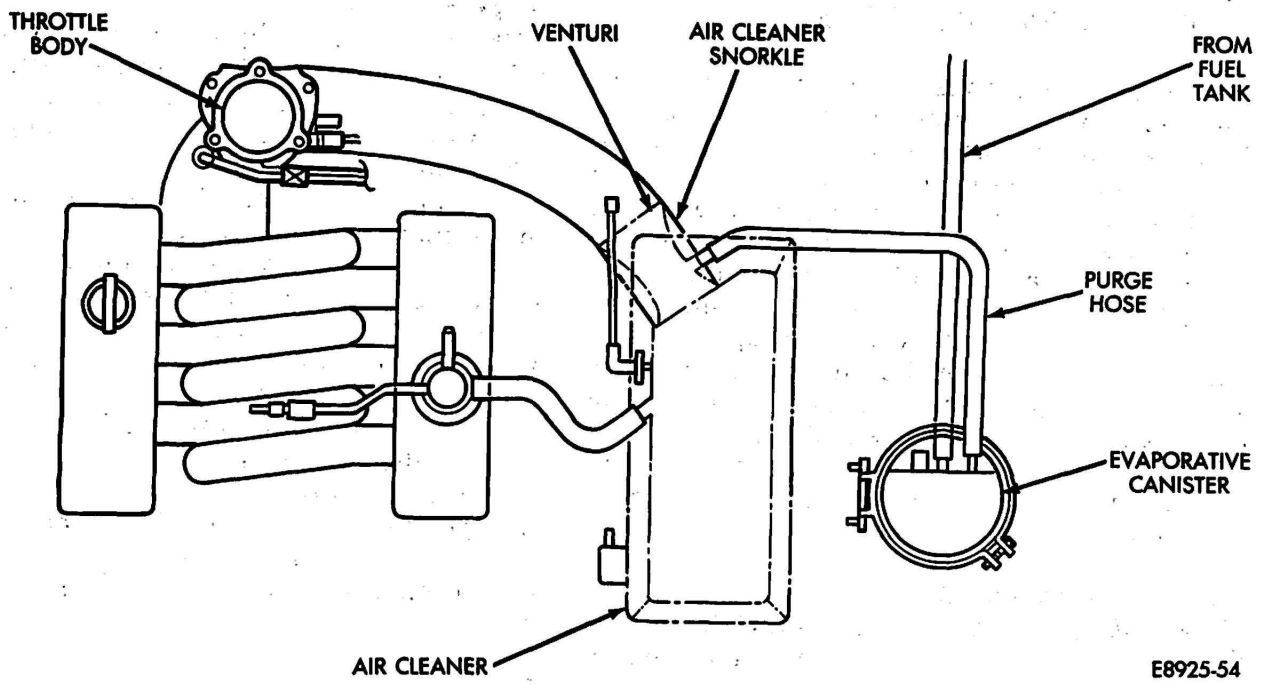


Fig. 4—Air Cleaner Venturi and Canister Purge Operation—3.0L Engine

When the engine is operating, the canister purge function draws fresh air through the filter at the bottom of the canister causing the stored vapors to be drawn out of the canister into the airstream in the air cleaner snorkel. The vapors are then drawn into the engine where they are consumed during combustion.

Pressure-Vacuum Fuel Tank Filler Cap

The fuel filler cap incorporates a two-way relief valve that is closed to atmosphere during normal operating conditions. The relief valve used in Premier fuel filler caps is calibrated to open only when a pressure of 10 kPa (1.5 psi) or a vacuum of 6 kPa (1.8 in. Hg) occurs within the fuel tank. When the pressure or vacuum is relieved the valve returns to the normally closed position.

WARNING: THE FUEL FILLER CAP MUST BE REMOVED TO RELIEVE FUEL TANK PRESSURE PRIOR TO DISCONNECTING ANY FUEL SYSTEM COMPONENT.

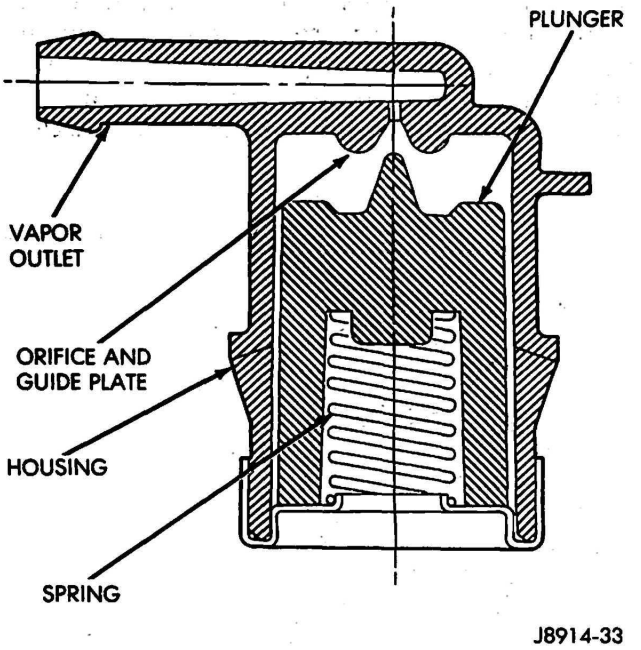


Fig. 5—Rollover Valve Operation

Crankcase Ventilation (CCV) Systems

The 3.0L engines are equipped with a Crankcase Ventilation System (Fig. 7). The Crankcase Ventilation System (CCV) mixes crankcase vapors with fresh air from the air cleaner. This mixture is drawn into the intake manifold via a metered orifice.

The CCV system performs the same function as a conventional PCV system, but does not use a vacuum controlled valve.

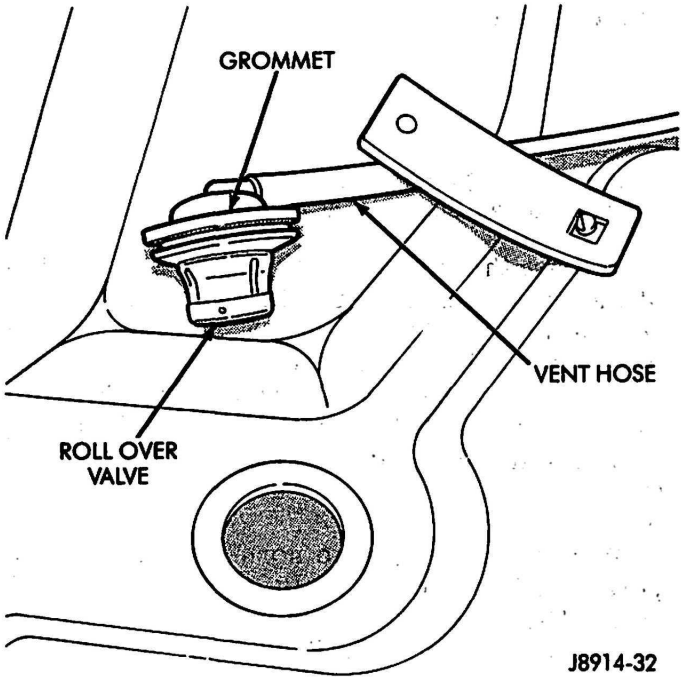


Fig. 6—Rollover Valve

The CCV system consists of a fitting in the intake manifold connected to the outlet nipple of the oil vapor separator (Fig. 7). The nipple contains a 2.2 mm orifice that meters the amount of crankcase vapors drawn out of the engine through the oil separator. A hose from the air cleaner that is connected to the other side of the oil separator supplies fresh air from the air cleaner to the oil separator.

When the engine is operating, vacuum from the intake manifold draws on the oil separator causing vapors from the engine and fresh air from the air cleaner to mix. The vapor/air mixture is drawn into the intake manifold through the metered orifice in the oil separator outlet nipple. The vapors are consumed during combustion.

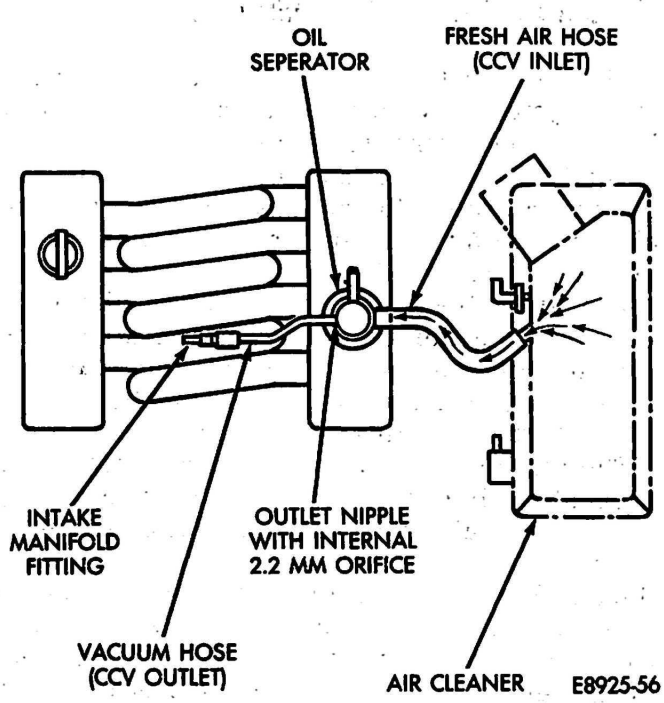


Fig. 7—CCV System

EXHAUST EMISSION CONTROLS

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Heated Oxygen Sensor (O_2 Sensor)	7
Thermostatic Air Cleaner (TAC)	6

THERMOSTATIC AIR CLEANER (TAC)

The thermostatically controlled air cleaner (TAC) system provides heated air to the throttle body during engine warm-up.

The TAC system is comprised of a heat stove that wraps around the exhaust manifold, a heated air tube, an air temperature sensor, and a vacuum motor operated air valve.

The air valve in the air cleaner blends air warmed from the heat stove on the air cleaner with ambient (outside) air. The air valve can close the opening to either air source or blend a mixture of both depending upon operating conditions.

The air valve in the air cleaner closes off the preheated air opening when vacuum is not applied to the air valve vacuum motor. When the engine is started, the temperature of the air in the air cleaner is monitored by the air temperature sensor. The air temperature sensor is located in the air cleaner cover on 3.0L engines. If the air temperature is below the calibrated opening point of the sensor, vacuum will be applied to the air valve vacuum motor to move the air valve towards the ambient air opening and only warmed air from the heat stove on the exhaust manifold will enter the air cleaner. As the exhaust manifold warms up and the temperature of the air entering the throttle body bonnet from the heat stove rises, the air temperature sensor begins to open and vacuum is bled off. This causes the air valve to start moving away from the ambient air opening towards the heat stove air opening. In this way, ambient air and heated air from the heat stove are blended for optimum engine performance and emission control.

Air Valve Vacuum Motor

Functional Test

(1) With the engine not operating, observe the ambient air inlet duct at the air cleaner and observe the position of the air valve. The air valve should be fully open to incoming ambient air (heat OFF position—Fig. 1).

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN DIRECT LINE WITH THE FAN. DO NOT PUT HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE FITTING CLOTHING.

(2) Start the engine and observe the position of the air valve. It should be fully closed to incoming ambient air (heat ON position—Fig. 2) below approximately 21°C (70°F) on 3.0L engines.

(3) Depress the throttle rapidly (1/2-3/4 position) and release. The air valve should briefly remain stationary and then move toward the heat OFF position and then back to the heat ON position.

(4) Warm the engine to normal operating temperature. Observe the ambient air duct and air valve. The air valve should be fully open to ambient air above 21°C (70°F) on 3.0L engines.

(5) Stop the engine.

(6) If the air valve does not function as described in the previous test, inspect for a mechanical bind in the snorkel, disconnected or leaking vacuum hoses, and vacuum leaks at the vacuum motor, air temperature sensor or intake manifold.

(7) If the air valve manually operates freely and the hoses are not leaking or disconnected, connect a vacuum hose from an intake manifold vacuum source directly to the vacuum motor and start the engine.

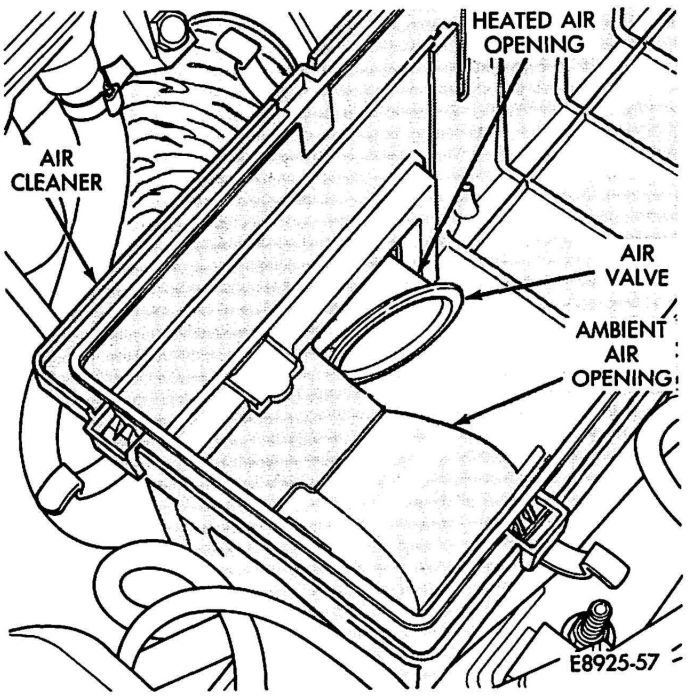


Fig. 1—Air Cleaner in Heat Off Position

(8) If the air valve closes, the air temperature sensor is defective and must be replaced. If the air valve does not close, replace the vacuum motor.

Air Valve Vacuum Motor Removal

(1) Remove the air cleaner.
(2) Disconnect the vacuum hose from the air valve motor.
(3) Remove the rivet attaching the air valve vacuum motor to the snorkel.
(4) Lift the motor, tilt it to one side to disconnect the motor linkage from the air valve assembly and remove the motor.

Air Valve Vacuum Motor Installation

(1) Insert the replacement vacuum motor linkage into the air valve assembly and position it in the snorkel.
(2) Attach the motor to the snorkel with a rivet. Ensure that the rivet does not interfere with the movement of the air valve.
(3) Connect the vacuum hose. Install the air cleaner assembly and test for proper operation of the TAC system.

Air Temperature Sensor

Functional Test

(1) Disconnect the vacuum hoses from the air temperature sensor (located on the air cleaner cover on 3.0L engines).

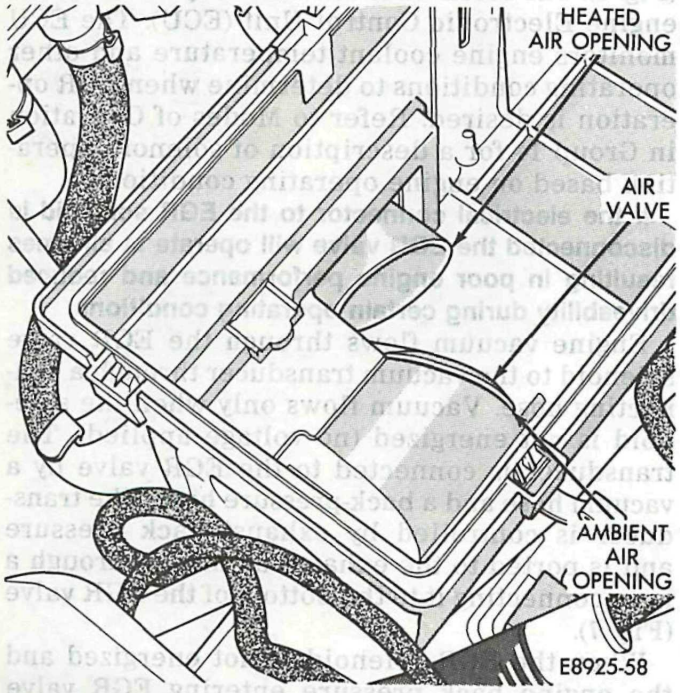


Fig. 2—Air Cleaner in Heat On Position

(2) Connect a hand operated vacuum pump to the vacuum source side of the sensor and a vacuum gauge to the vacuum motor side of the sensor.
(3) Apply 47 kPa (16 in. Hg) vacuum to the sensor.
(4) With the sensor at temperature below 10°C (50°F) on 3.0L engines, vacuum should be maintained.
(5) Warm the sensor to above 21°C (70°F) on 3.0L engines. The vacuum should not be maintained by the sensor. Replace the sensor if defective.

Removal

On 3.0L engines, the air temperature sensor is located in the air cleaner cover.
(1) Mark air temperature sensor vacuum tubes for installation reference (Fig. 3). Remove vacuum tubes from air temperature sensor.
(2) Remove the air cleaner cover.
(3) Remove air temperature sensor retaining clips (Fig. 4). Remove sensor.

Installation

(1) Install air temperature sensor in air cleaner cover. Secure with retaining clips.
(2) Install air cleaner cover to air cleaner.
(3) Connect vacuum tubes to air temperature sensor.

HEATED OXYGEN SENSOR (O_2 SENSOR)

The oxygen sensor (Fig. 5) is located in the exhaust manifold and provides an input voltage to the engines' Electronic Control Unit (ECU) relating the oxygen content of the exhaust gas. The ECU uses this information to vary the air-fuel ratio. A lean air/fuel mixture causes a greater

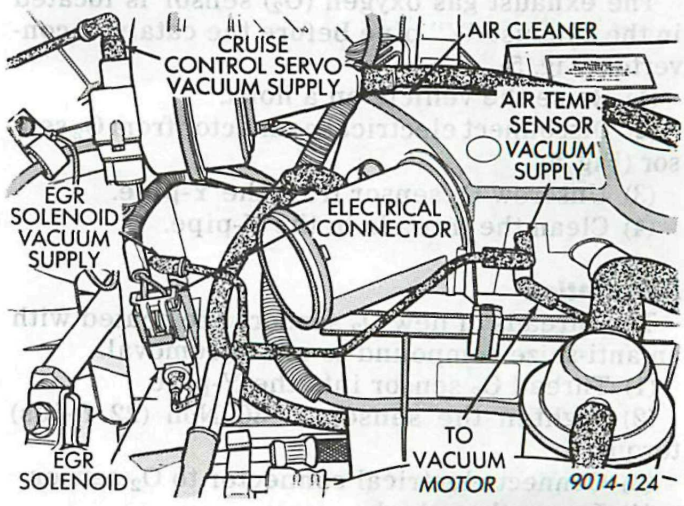


Fig. 3—Air Temperature Sensor Vacuum Tube Connections

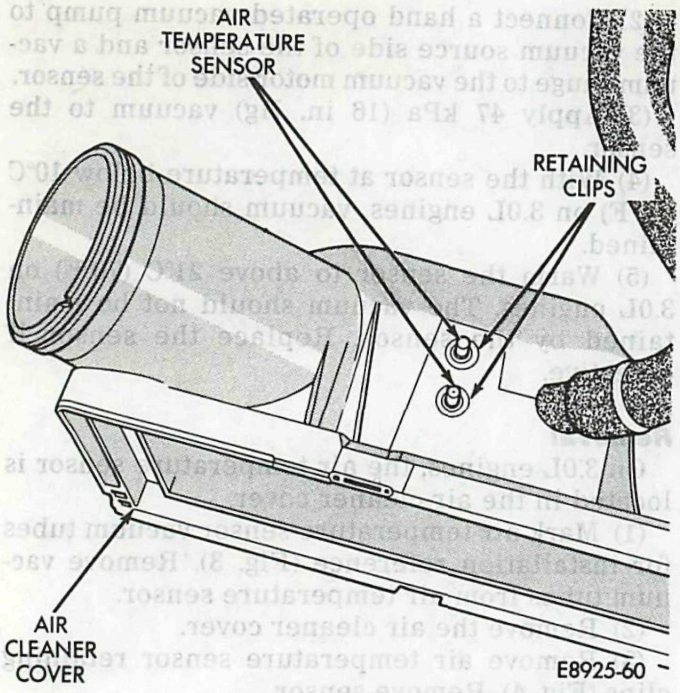


Fig. 4—Air Temperature Sensor Removal/Installation

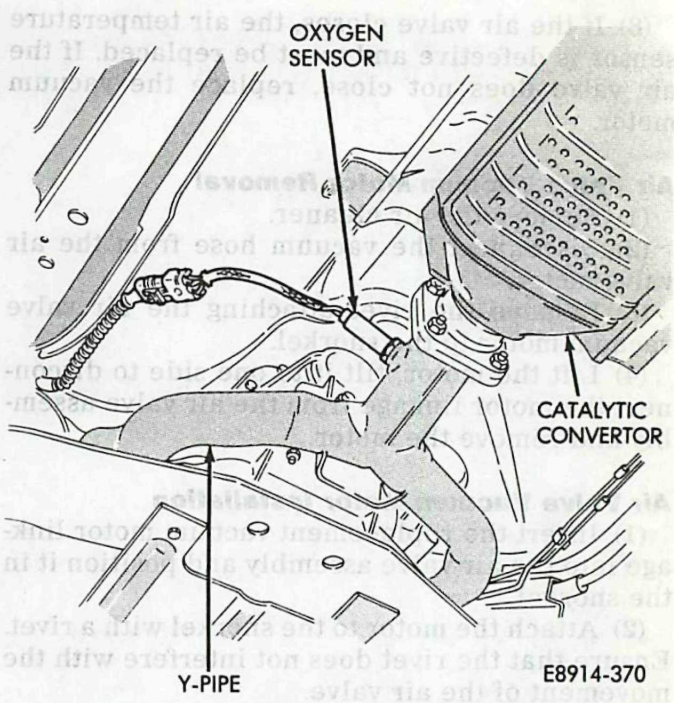


Fig. 5—Heated Oxygen Sensor—3.0L Engine

oxygen content in the exhaust gas and a rich air/fuel mixture causes less oxygen content.

The oxygen sensors used on the 3.0L engines are equipped with a heating element that keeps the sensor at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner and to remain in closed loop operation during periods of extended idle. Refer to MPI (3.0L) Modes of Operation section in group 14 for an explanation of OPEN and CLOSED LOOP operation.

Removal

The exhaust gas oxygen (O_2) sensor is located in the exhaust "Y" pipe before the catalytic converter (Fig. 5).

(1) Raise the vehicle on a hoist.

(2) Disconnect electrical connector from O_2 sensor (Fig. 5).

(3) Unscrew O_2 sensor from the Y-pipe.

(4) Clean the threads in the Y-pipe.

Installation

The threads of new O_2 sensors are coated with an anti-seize compound to aid in removal.

(1) Thread O_2 sensor into the Y-pipe.

(2) Tighten the sensor to 30 N·m (22 ft-lbs) torque.

(3) Connect electrical connector to O_2 sensor.

(4) Lower the vehicle.

EXHAUST GAS RECIRCULATION (EGR) SYSTEMS

The EGR system consists of an EGR valve solenoid, back pressure modulated vacuum transducer, and the EGR valve (Fig. 7).

The vacuum supply for the transducer and EGR valve is controlled by the EGR Valve Solenoid (Fig. 6). The solenoid is controlled by the vehicles' engine Electronic Control Unit (ECU). The ECU monitors engine coolant temperature and other operating conditions to determine when EGR operation is desired. Refer to Modes of Operation in Group 14 for a description of solenoid operation based on engine operating conditions.

If the electrical connector to the EGR solenoid is disconnected the EGR valve will operate at all times resulting in poor engine performance and reduced driveability during certain operating conditions.

Engine vacuum flows through the EGR valve solenoid to the vacuum transducer through a connecting hose. Vacuum flows only when the solenoid is not energized (no voltage applied). The transducer is connected to the EGR valve by a vacuum hose and a back-pressure hose. The transducer is controlled by exhaust back pressure and is ported to the exhaust manifold through a hose connecting it to the bottom of the EGR valve (Fig. 7).

When the EGR solenoid is not energized and the engine back pressure entering EGR valve inlet is strong enough to close the transducer bleed valve, vacuum will be supplied to the EGR

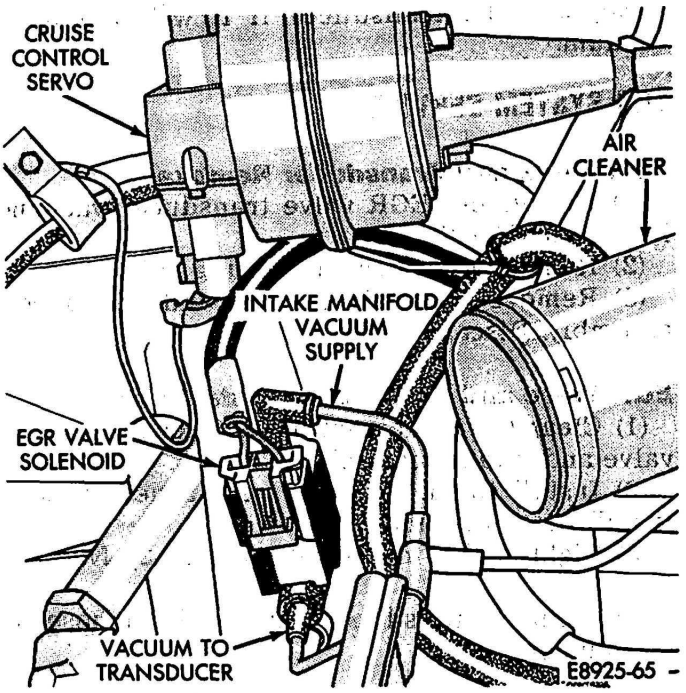


Fig. 6—EGR Valve Solenoid

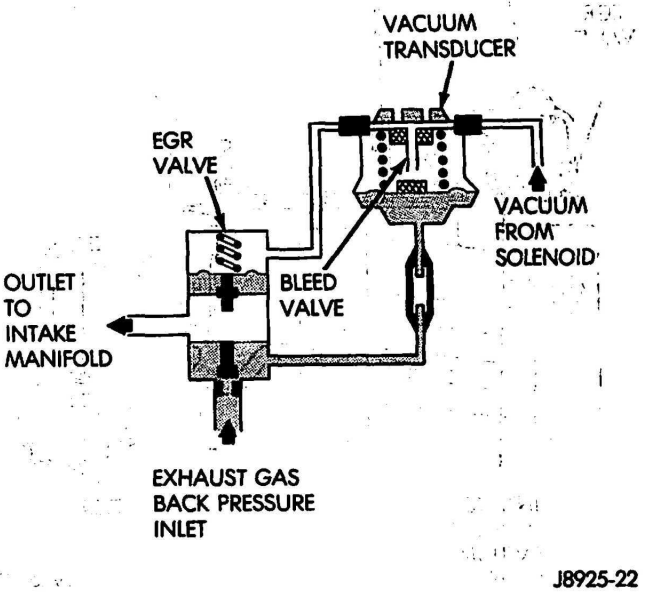


Fig. 8—EGR System Operation

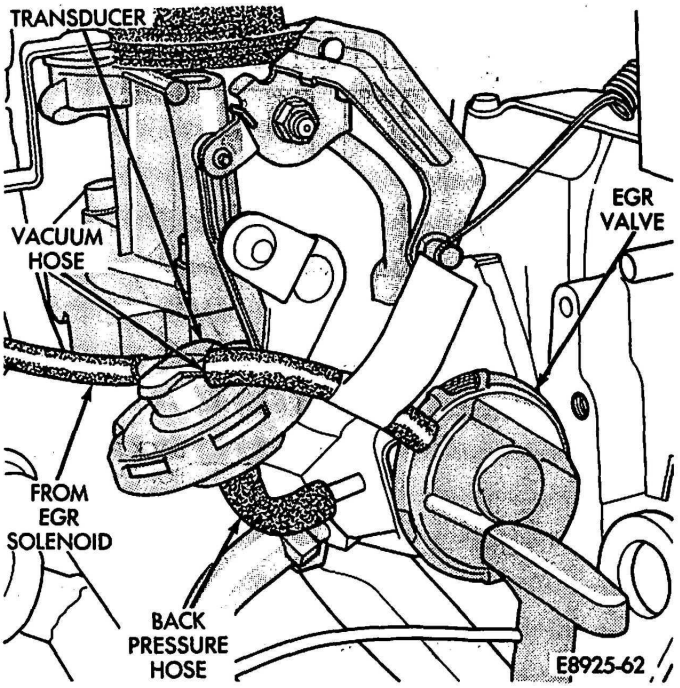


Fig. 7—EGR Valve and Transducer—3.0L Engine

valve and EGR operation will begin. If back pressure is not strong enough to close the transducer bleed valve, the transducer will bleed off the vacuum preventing EGR operation (Fig. 8).

When the EGR solenoid is de-energized by the ECU, vacuum flows to the transducer. The transducer is connected to the engine exhaust system by a small hose that connects to the base of the EGR valve.

EGR System Component Testing

(1) Bring the engine to normal operating temperature. Operate at idle speed. Test the EGR solenoid as follows:

(2) Check vacuum at solenoid vacuum source (Fig. 9). Disconnect the hose and attach a vacuum gauge to it.

(3) Vacuum should be a minimum of 15 inches.

- If vacuum is low, check the line for kinks, twists, or a loose connection at vacuum connector or intake manifold (Fig. 9).
- If vacuum is OK, remove gauge, reconnect the line and proceed to next step.

(4) Check vacuum at solenoid output port (Fig. 9).

(5) Disconnect the line and attach a vacuum gauge to output port (Fig. 9). Vacuum reading should be zero (no vacuum) at this side of solenoid.

- If vacuum reading is zero, leave the gauge connected and proceed to next step. However, if vacuum is present, check solenoid/ECU operation with the DRBII Service Diagnostic Tester and repair as necessary.

(6) Disconnect electrical connector at solenoid and note vacuum at solenoid output port. Vacuum should now be present at output port (Fig. 9).

- If vacuum is present, proceed to EGR valve test. However, if vacuum is not present, replace the solenoid.

Test the EGR valve as follows:

(1) Leave solenoid electrical connector disconnected. Bypass the vacuum transducer and con-

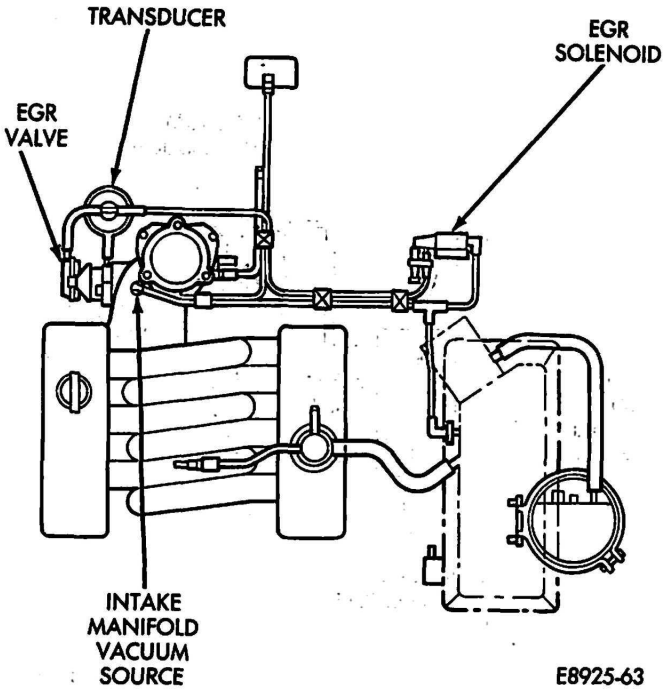


Fig. 9—EGR System Testing—3.0L Engine

nect the EGR valve solenoid output hose directly to the nipple on the EGR valve and note engine idle.

• The engine should now idle roughly or stall. If this occurs, the valve is OK. Proceed to Vacuum Transducer Test. However, if idle does not change, proceed to next step.

(2) Disconnect hose from EGR valve and connect a hand vacuum pump to EGR valve nipple (Fig. 9).

(3) Apply a minimum of 12 inches vacuum to the valve and note engine idle. If engine now idles roughly, inspect vacuum lines between vacuum connector on intake manifold (Fig. 9) and EGR valve, and back-pressure hose from EGR valve base to transducer for leaks. If no leaks are found proceed to vacuum transducer test.

(4) If the idle did not change, remove the EGR valve and inspect the valve and the exhaust passage in the manifold for blockage, repair as necessary. If no blockage is present replace the EGR valve.

Test the Vacuum Transducer as follows:

(1) Disconnect the transducer vacuum lines and back-pressure line. Remove transducer.

(2) Plug transducer output port (Fig. 10).

(3) Apply 1-2 pounds air pressure to transducer back-pressure port. Air pressure can be supplied with a hand operated air pump or compressed air (regulated to correct psi).

(4) Apply a minimum of 12 inches vacuum to input port.

Replace the transducer if it will not hold vacuum.

EGR SYSTEM SERVICE

EGR Valve and Transducer Removal

(1) Disconnect EGR valve transducer vacuum inlet hose (Fig. 7).

(2) Remove EGR valve mounting bolts.

(3) Remove EGR valve, gasket and transducer assembly. Discard gasket.

EGR Valve and Transducer Installation

(1) Clean the gasket mating surfaces of the EGR valve and Intake manifold.

(2) Install the EGR valve with a new gasket. Install the transducer.

(3) Tighten the mounting bolts to 27 N·m (20 ft-lbs).

(4) Connect transducer vacuum inlet hose to transducer.

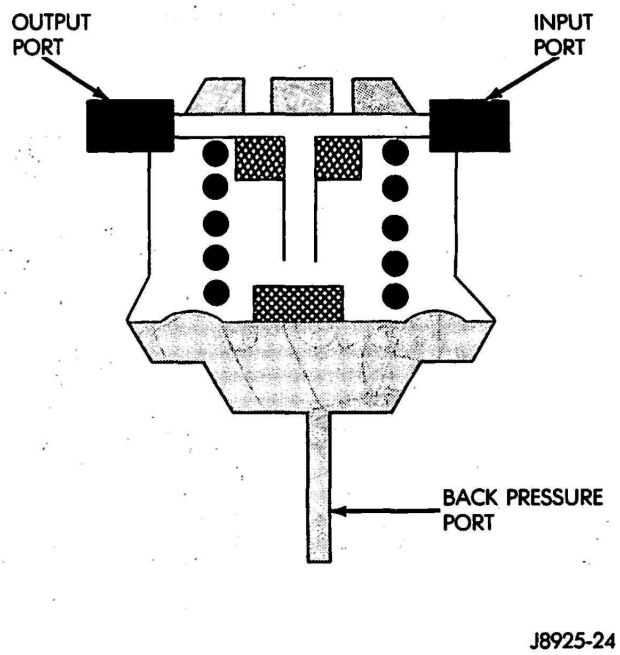


Fig. 10—Transducer Testing

Removal

The EGR tube is connected to the throttle body adapter and the right side exhaust manifold.

(1) Unscrew the EGR tube line nut from the throttle body adapter (Fig. 11).

(2) Remove the EGR flange bolts from the right side exhaust manifold (Fig. 12).

(3) Remove EGR tube.

(4) Remove any old gasket material from the exhaust manifold.

Installation

(1) Start EGR tube into throttle body adapter, but do not tighten line nut at this time.

(2) Install EGR tube flange and new gasket on exhaust manifold.

(3) Tighten flange mounting bolts to 19 N·m (14 ft-lbs) torque.

(4) Tighten line nut to 40 N·m (30 ft-lbs) torque.

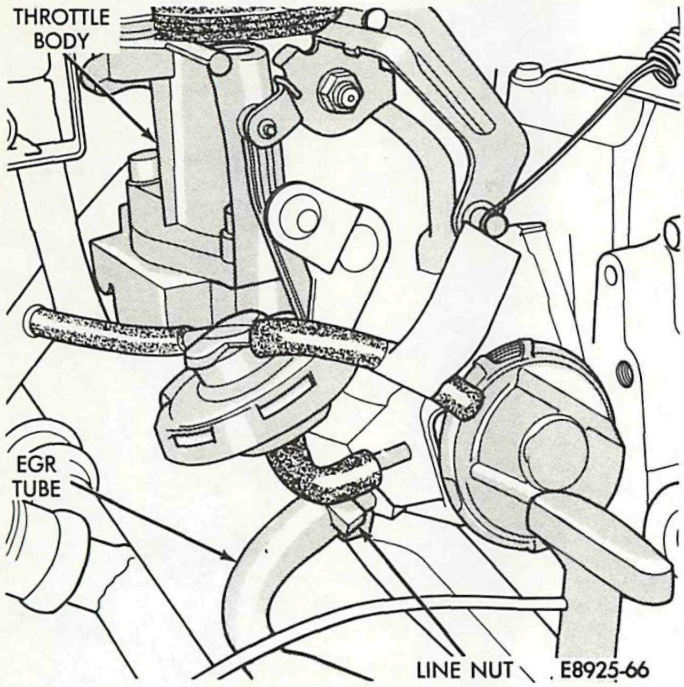


Fig. 11—EGR Tube to Throttle Body Connection

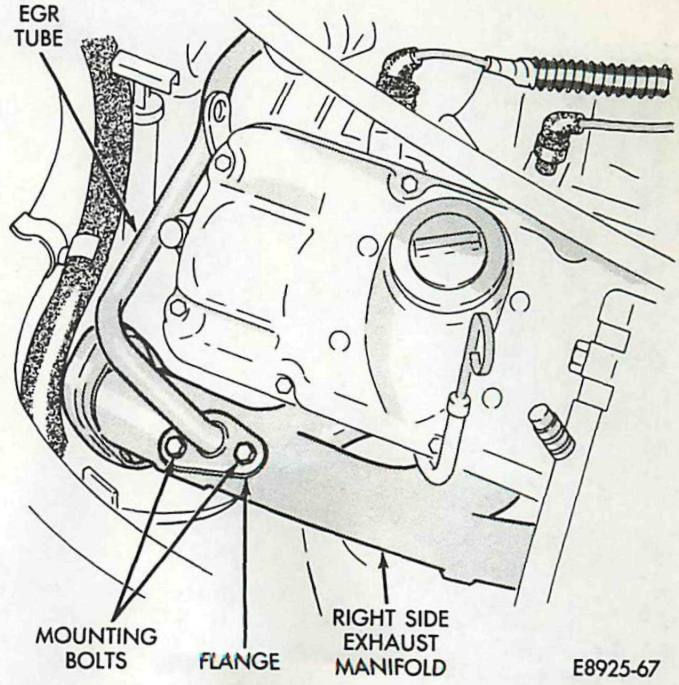


Fig. 12—EGR Tube to Exhaust Manifold Connection

EGR
TUBE
BOLTS
MOUNTING
MANIFOLD
EXHAUST
RIGHT SIDE

EGR
TUBE
BOLTS
MOUNTING

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